TITLE 179 PUBLIC WATER SYSTEMS

CHAPTER 3 MONITORING AND ANALYTICAL REQUIREMENTS

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CHAPTER 3 MONITORING AND ANALYTICAL REQUIREMENTS

3-001 SCOPE AND AUTHORITY: These regulations govern the monitoring and analytical requirements of public water systems. The statutory authority is found in Neb. Rev. Stat. §§ 71-5301 to 71-5313.

3-002 DEFINITIONS

Compliance cycle means the nine-year calendar year cycle during which public water systems must monitor. Each compliance cycle consists of three three-year compliance periods. The first calendar year cycle began January 1, 1993 and ended December 31, 2001; the second began January 1, 2002 and ended December 31, 2010; the third began January 1, 2011 and ends December 31, 2019.

Compliance period means a three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. Within the first compliance cycle, the first compliance period ran from January 1, 1993 to December 31, 1995; the second from January 1, 1996 to December 31, 1998; the third from January 1, 1999 to December 31, 2001.

Department means the Division of Public Health of the Department of Health and Human Services.

Director means the Director of Public Health of the Division of Public Health or his/her authorized representative.

Ground water under the direct influence of surface water means any water beneath the surface of the ground with significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia lamblia* or *Cryptosporidium*, or significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the Department. The Department determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well construction characteristics and geology with field evaluation as described in 179 NAC 13 Attachment 2.

Initial compliance period means the three-year compliance period which ended December 31, 1995 except as follows. For the contaminants listed in 179 NAC 2-002.04A(1), (5), (8), (11), (17); and in 2-002.04B1 (19), (20), (21); and in 2-002.04B2(19) to (33); the initial

compliance period means the three-year compliance period which began January 1, 1993 and ended December 31, 1995 for systems with 150 or more service connections, and means the three-year compliance period which began January 1, 1996 and ended December 31, 1998 for systems having fewer than 150 service connections.

3-003 GENERAL: The owners of public water systems are responsible for accomplishing monitoring requirements as demonstrated by possession of an official copy of laboratory results. The Director will establish schedules for sampling. Samples will be examined at timed intervals and on schedules designed to meet monitoring requirements and maintain a uniform laboratory work load. The owner of each public water system will be informed of this schedule and, if for any reason the schedule is not met, will be responsible for initiating arrangements for an alternate date to effect compliance with established monitoring requirements. The arrangements must be timed to provide the required number of samples within the designated sample period used to determine compliance with these regulations. All sample analyses needed to meet monitoring requirements of 179 NAC 3, unless otherwise stated, must be examined by the Department Laboratory or a laboratory which has entered into an agreement with the Department pursuant to 179 NAC 3-009.

3-004 COLIFORM SAMPLING: The provisions of 179 NAC 3-004.01 and 3-004.04 are applicable until March 31, 2016. The provisions of 179 NAC 3-004.02, 3-004.03, 3-004.05, 3-004.06, and 3-004.07 are applicable until all required repeat monitoring under 179 NAC 3-004.02 and fecal coliform or *E. coli* testing under 179 NAC 3-004.05 that was initiated by a total coliform-positive sample taken before April 1, 2016 is completed, as well as analytical method, reporting, recordkeeping, public notification, and consumer confidence report requirements associated with that monitoring and testing. Beginning April 1, 2016, the provisions of 179 NAC 26 are applicable, with systems required to begin regular monitoring at the same frequency as the system-specific frequency required on March 31, 2016.

3-004.01 Routine Monitoring

3-004.01A The owners of public water systems must collect total coliform samples at sites which are representative of water throughout the distribution systems according to a written sample site plan. These plans are subject to review and revision by the Director. All biological samples must be mailed to the assigned laboratory through the U.S. Postal Service, with the owner paying the postage, unless the Director authorizes other means of transportation. The sample site plan must consist of sampling points at sites scattered throughout various zones of the distribution system. Each plan must provide for at least five sampling sites in each zone and there must be as many zones as the number of routine total coliform samples required each month up to 16 zones. Systems which are required to collect more than 16 samples per month may elect to have more than 16 zones, but it is not required. A map of the area served by the public water system, showing the distribution system and the boundaries of the various zones, labeled numerically, must be included in the plan. A list of all sampling sites, by name and address (or by a readily identifiable location) for each zone must be included with the map and, except for supplies having only one zone, the location of the sites need not be indicated on the map. All zones must be sampled monthly. The actual sites used within each zone must be varied on a scheduled rotation basis. Both the zone number and the site location must be noted on the laboratory report form by the person taking the sample. The owner of each community water systems (CWS) must update the system's sample site plan annually. The Director, at any time, may

require a plan be modified as a result of population or system changes which may have rendered an existing plan non-representative.

3-004.01B The owner of a community water system must take total coliform samples at regular time intervals established by the Director. The number of samples required must in no instance be less than as set forth below:

Population Served	Number of Sampling Zones	Minimum # or Samples per Month	Population Served	Minimum # of Sampling Zones	Minimum # of Samples per Month
25-1,000	1	1	33,001-41,000	16	40
1,001-2,500	2	2	41,001-50,000	16	50
2,501-3,300	3	3	50,001-59,000	16	60
3,301-4,100	4	4	59,001-70,000	16	70
4,101-4,900	5	5	70,001-83,000	16	80
4,901-5,800	6	6	83,001-96,000	16	90
5,801-6,700	7	7	96,001-130,000	16	100
6,701-7,600	8	8	130,001-220,000	16	120
7,601-8,500	9	9	220,001-320,000	16	150
8,501-12,900	10	10	320,001-450,000	16	180
12,901-17,200	15	15	450,001-600,000	16	210
17,201-21,500	16*	20	600,001-780,000	16	240
21,501-25,000	16*	25	780,001-970,000	16	270
25,001-33,000	16*	30	970,001-1,230,000	16	300

* Minimum Number of Sampling Zones

3-004.01C The owner of a non-community water system must take samples for total coliforms according to a frequency as follows:

1. A non-community water system using only ground water (except ground water under the direct influence of surface water) and serving 1,000 individuals or fewer must sample each calendar quarter that the system provides water to the public.

2. A non-community water system using only ground water (except ground water under the direct influence of surface water) and serving more than 1,000 individuals during any month must sample at the same frequency as a like-sized community water system, as specified in 179 NAC 3-004.01B.

3. The owner of a non-community water system using surface water, in total or in part, must sample at the same frequency as a like-sized community water system, as specified in 179 NAC 3-004.01B, regardless of the number of individuals it serves.

4. The owner of a non-community water system using ground water under the direct influence of surface water, must sample at the same frequency as a like-sized community water system, as specified in 179 NAC 3-004.01B. The owner must sample at this frequency beginning six months after the Director determines that the ground water is under the direct influence of surface water.

3-004.01D The owner of a public water system must collect samples at regular time intervals throughout the month.

3-004.01E The owner of a public water system that uses surface water or ground water under the direct influence of surface water and does not practice filtration in compliance with 179 NAC 13 must collect at least one sample near the first service connection each day the turbidity level of the source water, measured as specified in 179 NAC 13-007.02B exceeds 1 NTU. The owner must collect this coliform sample within 24 hours of the first exceedance. Sample results from this coliform monitoring must be included in determining compliance with the maximum contaminant level (MCL) for total coliforms in 179 NAC 2-002.04C.

3-004.01F Special purpose samples, such as those taken to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, must not be used to determine compliance with the MCL for total coliforms in 179 NAC 2-002.04C. Repeat samples taken pursuant to 179 NAC 3-004.02 are not considered special purpose samples, and must be used to determine compliance with the MCL for total coliforms in 179 NAC 2-002.04C.

3-004.02 Repeat Monitoring

3-004.02A If a routine sample is total coliform-positive, the owner of the public water system must collect a set of repeat samples within 24 hours of being notified of the positive result. A system which is required to collect more than one routine sample per month must have no fewer than three repeat samples collected for each total coliform-positive sample found. A system which is required to collect one routine sample per month or fewer must have no fewer than four repeat samples collected for each total coliform-positive sample found. The Director may extend the 24-hour limit on a case-by-case basis if the owner has a logistical problem in collecting the repeat samples within the 24 hours that is beyond his/her control. In the case of an extension, the Director must specify how much time the owner has to collect the repeat samples.

3-004.02B The system owner must collect at least one repeat sample from the sampling tap where the original total coliform-positive sample was taken, and at least one repeat sample at a tap within five service connections upstream and at least one repeat sample at a tap within five service connections downstream of the original sampling site. The fourth repeat sample, if required by 179 NAC 3-004.02A, must be collected within five service connections upstream or downstream of the original sampling site. If a total coliform-positive sample is at the end of the distribution system, or one away from the end of the distribution system, the Director may waive the requirement to collect at least one repeat sample upstream or downstream of the original sampling site.

3-004.02C The owner must collect all repeat samples on the same day, except that an owner of a system with a single service connection may collect the required set of repeat samples over a four-day period.

3-004.02D If one or more repeat samples in the set is total coliform-positive, the owner of the public water system must collect an additional set of repeat samples in the manner specified in 179 NAC 3-004.02A to 3-004.02C. The owner must repeat

this process until either total coliforms are not detected in one complete set of repeat samples or the MCL for total coliforms in 179 NAC 2-002.04C has been exceeded and the Director determines that no additional repeat samples are required.

3-004.02E If a system which is required to collect fewer than five routine samples per month has one or more total coliform-positive samples and the Director does not invalidate the sample(s) under 179 NAC 3-004.03, the owner must collect at least five routine samples during the next month the system provides water to the public, except that the Director may waive this requirement if the conditions of 179 NAC 3-004.02E1 or 3-004.02E2 are met. The Director will not waive the requirement for a system to collect repeat samples in 179 NAC 3-004.02A to 3-004.02D.

3-004.02E1 The Director may waive the requirement to collect five routine samples the next month the system provides water to the public if the Director or an agent approved by the Director performs a site visit before the end of the next month the system provides water to the public. Although a sanitary survey need not be performed, the site visit must be sufficiently detailed to allow the Director to determine whether additional monitoring and/or any corrective action is needed. The Director will not approve an employee of the system owner to perform this site visit, even if the employee is an agent approved by the Director to perform sanitary surveys.

3-004.02E2 The Director may waive the requirement to collect five routine samples the next month the system provides water to the public if the Director has determined why the sample was total coliform-positive and establishes that the owner of the system will correct the problem before the end of the next month the system serves water to the public. In this case, the Director must document this decision to waive the following month's additional monitoring requirement in writing, have it approved and signed by the supervisor of the Director's authorized representative who recommends such a decision, and make this document available to the United States Environmental Protection Agency (EPA) and the public. The written documentation must describe the specific cause of the total coliform-positive sample and what action the system has taken and/or will take to correct this problem. The Director will not waive the requirement to collect five routine samples the next month the system provides water to the public solely on the grounds that all repeat samples are total coliform-negative. If the requirement to collect five routine samples the next month is waived under 179 NAC 3-004.02E2, the system owner must still take at last one additional routine sample before the end of the next month the system serves water to the public and use it to determine compliance with the MCL for total coliforms in 179 NAC 2-002.04C.

3-004.02E3 The Director will consider the waiver of the requirement to collect five routine samples the next month only upon receipt of a request in writing from the system owner. The waiver will not be considered until after the repeat samples required in 179 NAC 3-004.02A to 3-004.02D have been collected and the results reported to the Director. The waiver will not be granted if any of the repeat samples are coliform-positive, unless all positive samples have been invalidated under 179 NAC 3-004.03, or if a similar waiver

has been granted within the six months previous to the date of the collection of the initial coliform positive sample.

3-004.02F Results of all routine and repeat samples not invalidated by the Director must be included in determining compliance with the MCL for total coliforms in 179 NAC 2-002.04C.

3-004.03 Invalidation of Total Coliform Samples: A total coliform-positive sample invalidated under 179 NAC 3-004.03 does not count towards meeting the minimum monitoring requirements of 179 NAC 3-004.01. If a total coliform-positive sample is invalidated under 179 NAC 3-004.03, the system owner must collect another sample from the same zone as the original sample to meet monitoring requirements.

3-004.03A The Director may invalidate a total coliform-positive sample only if one or more of the following conditions are met:

1. The laboratory establishes that improper sample analysis caused the total coliform-positive result.

2. The Director, on the basis of the results of repeat samples collected as required by 179 NAC 3-004.02A to 3-004.02D determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. The Director will not invalidate a sample on the basis of repeat sample results unless all repeat sample(s) collected at the same tap as the original total coliform-positive sample are also total coliform-positive, and all repeat samples collected within five service connections of the original tap are total coliform-negative (e.g., the Director will not invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative or if the public water system has only one service connection).

3. The Director has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. In this case, the system owner must still collect all repeat samples required under 179 NAC 3-004.02A to 3-004.02D and use them to determine compliance with the MCL for total coliforms in 179 NAC 2-002.04C. To invalidate a total coliform-positive sample under 179 NAC 3-004.03A item 3, the decision with the rationale for the decision must be documented in writing and approved and signed by the Director's authorized representative. The Director must make this document available to EPA and the public. The written documentation must state the specific cause of the total coliform-positive sample, and what action the system has taken or will take to correct this problem. The Director will not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative.

4. The Director will consider invalidation of a coliform-positive sample under 179 NAC 3-004.03 only upon receipt of a request in writing from the owner of the public water system from which the coliform-positive sample was collected. Such sample will not be invalidated if any of the

repeat samples collected at locations other than that of the coliform-positive sample are coliform-positive. No coliform-positive sample will be invalidated if any of the most recent six samples collected from the system were coliform-positive.

3-004.03B A laboratory must invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the Multiple-Tube-Fermentation Technique), produces a turbid culture in the absence of an acid reaction in the Presence-Absence (P-A) Coliform Test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., Membrane Filter Technique). If a laboratory invalidates a sample because of such interference, the system owner must collect another sample from the same location as the original sample within 24 hours of being notified of the interference problem, and have it analyzed for the presence of total coliforms. The system owner must continue to re-sample within 24 hours and have the samples analyzed until a valid result is obtained. The Director may waive the 24-hour time limit on a case-by-case basis.

3-004.04 Sanitary Surveys

3-004.04A Public water systems which do not collect five or more routine samples per month must undergo an initial sanitary survey by June 29, 1994, for community public water systems and June 29, 1999, for non-community systems. Thereafter, systems must undergo another sanitary survey every five years, except that non-community water systems using only disinfected ground water and wells which have been constructed in accordance with and continue to meet the siting requirements of 179 NAC 7, must undergo subsequent sanitary surveys at least every ten years after the initial sanitary survey.

3-004.04B Sanitary surveys must be performed by Department personnel or an agent approved by the Department. The system is responsible for ensuring the survey takes place.

3-004.04C Sanitary surveys conducted by the Department under 179 NAC 8-004 ~~(upon its effective date)~~ may be used to meet the sanitary survey requirements of 179 NAC 3-004.04.

3-004.05 Fecal Coliforms/*Escherichia coli (E. coli)* Testing

3-004.05A If any routine or repeat sample is total coliform-positive, that total coliform-positive culture medium must be analyzed to determine if fecal coliforms are present, except that *E. coli* may be tested for in lieu of fecal coliforms. If fecal coliforms or *E. coli* are present in samples analyzed by a laboratory other than the Department Laboratory, the system owner must notify the Director by the end of the day when the system owner is notified of the test result, unless the system owner is notified of the result after the Director's office is closed, in which case the system owner must notify the Director before the end of the next business day.

3-004.05B The Director has the discretion to allow the owner of a public water system, on a case-by-case basis, to forgo fecal coliform or *E. coli* testing on a total

coliform-positive sample if the owner assumes that the total coliform-positive sample is fecal-coliform-positive or *E. coli*-positive. Accordingly, the owner must notify the Director as specified in 179 NAC 3-004.05A and the provisions of 179 NAC 2-002.04C2 apply.

3-004.06 Analytical Methodology

3-004.06A The standard sample volume required for total coliform analysis, regardless of analytical method used, is 100 ml.

3-004.06B Public water systems need only determine the presence or absence of total coliforms; a determination of total coliform density is not required.

3-004.06C Public water systems must conduct total coliform analyses in accordance with one of the analytical methods in the following table or an equivalent method approved by EPA. These methods are incorporated herein by reference and are available for viewing at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509. Copies may be obtained from the addresses listed below.

Organism	**Methodology[12]**	**Citation[1]**
Total Coliforms[2]	Total Coliform Fermentation Technique[3,4,5]	9221 A,B
	Total Coliform Membrane Filter Technique[6]	9222 A, B, C
	Presence-Absence (P-A) Coliform Test[5,7]	9221 D
	ONPG-MUG Test[8]	9223
	Colisure Test[9]	
	E-Collite® Test[10]	
	m-Coliblue24® Test[11]	
	Readycult® Coliform 100 Presence/Absence Test[13]	
	Membrane Filter Technique using Chromocult® Coliform Agar[14]	

[1]*Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), or 20th edition (1998). American Public Health Association, 1015 Fifteenth Street NW, Washington, D.C. 20005. The cited methods published in any of these three editions may be used. In addition, the following on-line versions may also be used: 9221 A, B, D-99, 9222 A, B, C-97, and 9223 B-97. Standard Methods Online are available at http://www.standardmethods.org. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only Online versions that may be used.

[2]The time from sample collection to initiation of analysis may not exceed 30 hours. Systems are encouraged but not required to hold samples below 10°C during transit.

[3]Lactose broth, as commercially available, may be used in lieu of lauryl tryptose broth, if the system conducts at least 25 parallel tests between this medium and lauryl tryptose broth using the water normally tested, and this comparison demonstrates that the false-positive rate and false-negative rate for total coliforms, using lactose broth, is less than 10%.

[4]If inverted tubes are used to detect gas production, the media should cover these tubes at least one-half to two-thirds after the sample is added.

[5]No requirement exists to run the completed phase on 10% of all total coliform-positive confirmed tubes.

[6]MI agar also may be used. Preparation and use of MI agar is set forth in the article, "New medium for the simultaneous detection of total coliform and *Escherichia coli* in water" by Brenner, K.P., et al, 1993, Appl. Environ. Microbiol. 59:3534-3544. Also available from the Office of Water Resource Center (RC-

4100T), 1200 Pennsylvania Avenue, NW, Washington, D.C. 20460, EPA/600/J-99/225. Verification of colonies is not required.

[7]Six-times formulation strength may be used if the medium is filter-sterilized rather than autoclaved.

[8]The ONPG-MUG Test is also known as the Autoanalysis Colilert System.

[9]A description of the Colisure Test, Feb. 28, 1994, may be obtained from IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092. The Colisure Test may be read after an incubation time of 24 hours.

[10]A description of the E-Colite® Test, "Presence/Absence for Coliforms and *E. Coli* in Water," Dec. 21, 1997, is available from Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148-4120.

[11]A description of the m-ColiBlue24® Test, Aug. 17, 1999, is available from the Hach Company, 100 Dayton Avenue, Ames, IA 50010.

[12]EPA strongly recommends that laboratories evaluate the false-positive and negative rates for the method(s) they use for monitoring total coliforms. EPA also encourages laboratories to establish false-positive and false-negative rates within their own laboratory and sample matrix (drinking water or source water) with the intent that if the method they choose has an unacceptable false-positive or negative rate, another method can be used. EPA suggests that laboratories perform these studies on a minimum of 5% of all total coliform-positive samples, except for those methods where verification/confirmation is already required, e.g., the M-Endo and LES Endo Membrane Filter Tests, Standard Total Coliform Fermentation Technique, and Presence-Absence Coliform Test. Methods for establishing false-positive and negative rates may be based on lactose fermentation, the rapid test for β-galactosidase and cytochrome oxidase, multi-test identification systems, or equivalent confirmation tests. False-positive and false-negative information is often available in published studies and/or from the manufacturer(s).

[13]The Readycult® Coliforms 100 Presence/Absence Test is described in the document, "Readycult® Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters," November 2000, Version 1.0, available from EM Science (an affiliate of Merck KGgA, Darmstadt Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297. Telephone number is (800)222-0342, e-mail address is adellenbusch@emscience.com.

[14]Membrane Filter Technique using Chromocult® Coliform Agar is described in the document, "Chromocult® Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and Escherichia coli in Finished Waters," November 2000, Version 1.0, available from EM Science (an affiliate of Merck KGgA, Darmstadt Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297. Telephone number is (800)222-0342, e-mail address is adellenbusch@emscience.com.

3-004.06D Public water systems must conduct fecal coliform analysis in accordance with the following procedure. When the MTF Technique or Presence-Absence (PA) Coliform Test is used to test for total coliforms, shake the lactose-positive presumptive tube or P-A vigorously and transfer the growth with a sterile 3-mm loop or sterile applicator stick into a brilliant green lactose bile broth and EC medium to determine the presence of total and fecal coliforms, respectively. For Department-approved analytical methods that use a membrane filter, transfer the total coliform-positive culture by one of the following methods: remove the membrane containing the total coliform colonies from the substrate with a sterile forceps and carefully curl and insert the membrane into a tube of EC medium (the laboratory may first remove a small portion of selected colonies for verification), swab the entire membrane filter surface with a sterile cotton swab and transfer the inoculum to EC medium (do not leave the cotton swab in the EC medium), or inoculate individual total coliform-positive colonies into EC medium. Gently shake the inoculated tubes of EC medium to insure adequate mixing and incubate in a waterbath at 44.5 ± 0.2°C for 24 ± 2 hours. Gas production of any amount in the inner fermentation tube of the EC medium indicates a positive fecal coliform test. The preparation of EC medium is described in Method 9221E (paragraph 1a) in *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), and 20th edition (1998); the cited method in any one of

these three editions may be used. Public water systems need only determine the presence or absence of fecal coliforms; a determination of fecal coliform density is not required.

3-004.06E Public water systems must conduct analysis of *Escherichia coli* in accordance with one of the following analytical methods or an equivalent method approved by EPA:

1. EC medium supplemented with 50 µg/ml of 4-methylumbelliferyl-beta-D-glucoronide (MUG) (final concentration), as described in Method 9222G in *Standard Methods for the Examination of Water and Wastewater*, 19th edition (1995) and 20th edition (1998). Either edition may be used. Alternatively, the 18th edition (1992) may be used if at least 10 ml of EC medium as described in 179 NAC 3-004.06D, is supplemented with 50 µg/ml of MUG before autoclaving. The inner inverted fermentation tube may be omitted. If the 18th edition is used, apply the procedure in 179 NAC 3-004.06D for transferring a total coliform-positive culture to EC medium supplemented with MUG, incubate the tube at 44.5 ± 0.2°C for 24 ± 2 hours; and then observe fluorescence with an ultraviolet light (366 nm) in the dark. If fluorescence is visible, *E. coli* are present.

2. Nutrient agar supplemented with 100 µg/ml 4-methylumbelliferyl-beta-D-glucoronide (MUG) (final concentration) as described in Method 9222G in *Standard Methods for the Examination of Water and Wastewater*, 19th edition (1995) and 20th edition (1998). Either edition may be used for determining if a total coliform-positive sample, as determined by the Membrane Filter Technique, contains *E. coli*. Alternately, the 18th edition (1992) may be used if the membrane filter containing a total coliform-positive colony(ies) is transferred to a nutrient agar, as described in Method 9221B (paragraph 3) of *Standard Methods* (18th edition), supplemented with 100 µg/ml (final concentration) of MUG. If the 18th edition is used, incubate the agar plate at 35°C for 4 hours, observe the colony(ies) under ultraviolet light (366 nm) in the dark for fluorescence. If fluorescence is visible, *E. coli* are present.

3. Minimal Medium ONPG-MUG (MMO-MUG) Test, as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Detection of Total Coliforms and *Escherichia coli* from Drinking Water: Comparison with Presence-Absence Techniques" (Edberg et. al.), Applied and Environmental Microbiology, Volume 55, pp. 1003-1008, April 1989. (Note: The Autoanalysis Colilert System is an MMO-MUG test). If the MMO-MUG test is total coliform-positive after a 24-hour incubation, test the medium for fluorescence with a 366-nm ultraviolet light (preferably with a 6-watt lamp) in the dark. If fluorescence is observed, the sample is *E. Coli*-positive. If fluorescence is questionable (cannot be definitely read) after 24 hours incubation, incubate the culture for an additional four hours (but not to exceed 28 hours total), and again test the medium for fluorescence. The MMO-MUG Test with hepes buffer in lieu of phosphate buffer is the only approved formulation for the detection of *E. coli*.

4. The Colisure Test: A description of the Colisure Test may be obtained from the Millipore Corporation, Technical Services Department, 80 Ashby Road, Bedford, MA 01730.

5. The Membrane Filter Method with MI Agar, a description of which is cited in footnote 6 to the table in 179 NAC 3-004.06C.

6. E-Colite® Test, a description of which is cited in footnote 10 to the table in 179 NAC 3-004.06C.

7. m-ColiBlue24® Test, a description of which is cited in footnote 11 to the table in 179 NAC 3-004.06C.

8. Readycult® Coliforms 100 Presence/Absence Test, a description of which is cited in footnote 13 to the table in 179 NAC 3-004.06C.

9. Membrane Filter Technique using Chromocult® Coliform Agar, a description of which is cited in footnote 14 to the table in 179 NAC 3-004.06C.

3-004.06F As an option to 179 NAC 3-004.06E item 3, a system with a total coliform positive, MUG-negative, MMO-MUG test may further analyze the culture for the presence of *E. coli* by transferring a 0.1 ml, 28-hour MMO-MUG culture to EC Medium + MUG with a pipet. The formulation and incubation conditions of EC Medium + MUG, and observation of the results are described in 179 NAC 3-004.06E item 1.

3-004.07 Response to Violation

3-004.07A A public water system which has exceeded the MCL for total coliforms in 179 NAC 2-002.04C must report the violation to the Department no later than the end of the next business day after it learns of the violation, and notify the public in accordance with 179 NAC 4.

3-004.07B A public water system which has failed to comply with a coliform monitoring requirement, including the sanitary survey requirement, must report the monitoring violation to the Department within ten days after the system discovers the violation, and notify the public in accordance with 179 NAC 4.

3-005 INORGANIC CHEMICAL SAMPLING AND ANALYTICAL REQUIREMENTS: Community water systems and non-transient, non-community water systems must conduct monitoring to determine compliance with the maximum contaminant levels specified in 179 NAC 2-002.04A in accordance with 179 NAC 3-005. Transient, non-community water systems must conduct monitoring to determine compliance with the nitrate and nitrite maximum contaminant levels in 179 NAC 2-002.04A (12), (13), and (14) in accordance with 179 NAC 3-005. Monitoring must be conducted as follows.

3-005.01 Sampling Sites and Protocol

1. Ground Water Sources: Ground water sources must be monitored at every entry point to the distribution system which is representative of each ground

water source after treatment (hereafter called a sampling point or entry point). The system owner must take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

2. Surface Water Sources: Surface water sources must be monitored at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment (hereafter called a sampling point or entry point). The system owner must take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

   NOTE: For the purpose of 179 NAC 3-005.01 item 2, surface water systems include systems with a combination of surface and ground sources.

3. Multiple Sources: If a system draws water from more than one source and the sources are combined before distribution, the system owner must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all sources being used).

4. Composite Sampling: The Director may reduce the total number of samples which must be analyzed by allowing the use of compositing. Composite samples from a maximum of five sampling points are allowed. Compositing of samples must be done in the laboratory.

   a. If the concentration in the composite sample is greater than or equal to the detection limit of any inorganic chemical, then a follow-up sample must be analyzed within 14 days from each sampling point included in the composite. These samples must be analyzed for the contaminants which were detected in the composite sample. Detection limits for each analytical method are the following:

DETECTION LIMITS FOR INORGANIC CONTAMINANTS

Contaminant	MCL (mg/L)	Methodology	Detection Limit (mg/L)
Antimony	0.006	Atomic Absorption; Furnace	0.003
		Atomic Absorption; Platform	0.0008[5]
		ICP-Mass Spectrometry	0.0004
		Hydride- Atomic Absorption	0.001
Arsenic	0.010[6]	Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform - Stabilized Temperature	0.0005[7]
		Atomic Absorption; Gaseous Hydride	0.001
		ICP-Mass Spectrometry	0.0014[8]
Asbestos	7 MFL[1]	Transmission Electron Microscopy	0.01 MFL
Barium	2	Atomic Absorption; furnace technique	0.002
		Atomic Absorption; direct aspiration	0.1
		Inductively Coupled Plasma	0.002, (0.001)
Beryllium	0.004	Atomic Absorption; Furnace	0.0002
		Atomic Absorption; Platform	0.00002[5]

		Inductively Coupled Plasma[2]	0.0003
		ICP-Mass Spectrometry	0.0003
Cadmium	0.005	Atomic Absorption; furnace technique	0.0001
		Inductively Coupled Plasma	0.001
Chromium	0.1	Atomic Absorption; furnace technique	0.001
		Inductively Coupled Plasma	0.007 (0.001)
Cyanide	0.2	Distillation, Spectrophotometric[3]	0.02
		Distillation, Automated, Spectrophotometric[3]	0.005
		Distillation, Selective Electrode[3,4]	0.05
		Distillation, Amenable, Spectrophotometric[4]	0.02
		UV, Distillation, Spectrophotometric[9]	0.0005
		Micro Distillation, Flow Injection, Spectrophotometric[3]	0.0006
		Ligand Exchange with Amperometry[4]	0.0005
Mercury	0.002	Manual Cold Vapor Technique	0.0002
		Automated Cold Vapor Technique	0.0002
Nickel	xl	Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform	0.0006[5]
		Inductively Coupled Plasma[2]	0.005
		ICP-Mass Spectrometry	0.0005
Nitrate	10 (as N)	Manual Cadmium Reduction	0.01
		Automated Hydrazine Reduction	0.01
		Automated Cadmium Reduction	0.05
		Ion Selective Electrode	1
		Ion Chromatography	0.01
		Capillary Ion Electrophoresis	0.076
Nitrite	1 (as N)	Spectrophotometric	0.01
		Automated Cadmium Reduction	0.05
		Manual Cadmium Reduction	0.01
		Ion Chromatography	0.004
		Capillary Ion Electrophoresis	0.103
Selenium	0.05	Atomic Absorption; furnace	0.002
		Atomic Absorption; gaseous hydride	0.002
Thallium	0.002	Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform	0.0007[5]
		ICP-Mass Spectrometry	0.0003

[1] MFL = million fibers per liter >10 µm.
[2] Using a 2X preconcentration step as noted in Method 200.7. Lower MDLs may be achieved when using a 4X preconcentration.
[3] Screening method for total cyanides.
[4] Measures "free" cyanides when distillation, digestion, or ligand exchange is omitted.
[5] Lower MDLs are reported using stabilized temperature graphite furnace atomic absorption.
[6] The value for arsenic is effective January 23, 2006. Until then, the MCL is 0.05 mg/L.
[7] The MDL reported for EPA Method 200.9 (Atomic Absorption; Platform–Stabilized Temperature) was determined using a 2x concentration step during sample digestion. The MDL determined for samples analyzed using direct analyses (i.e., no sample digestion) will be higher. Using multiple depositions, EPA 200.9 is capable of obtaining an MDL of 0.0001 mg/L.
[8] Using selective ion monitoring, EPA Method 200.8 (ICP-MS) is capable of obtaining an MDL of 0.0001 mg/L.
[9] Measures total cyanides when UV-digestor is used, and “free” cyanides when UV-digestor is bypassed.

b. If the population served by the system is greater than 3,300 individuals, then compositing may only be permitted by the Director at sampling points within a single system. In systems serving less than or equal to 3,300 individuals, the Director may permit compositing among different systems provided the five-sample limit is maintained.

c. If duplicates of the original sample taken from each sampling point used in the composite are available, the system owner may use these instead of resampling. The duplicates must be analyzed and the results reported to the Director within 14 days of collection.

3-005.02 Asbestos Sampling: The frequency of monitoring conducted to determine compliance with the maximum contaminant level for asbestos must be conducted as follows:

1. Each community and non-transient, non-community water system owner must monitor for asbestos during the first three-year compliance period of each nine-year compliance cycle beginning in the compliance period which ends December 31, 1995.

2. Waiver from Monitoring: If a system owner believes its water system is not vulnerable to either asbestos contamination in its source water or due to corrosion of asbestos-cement pipe, or both, it may apply to the Director for a waiver from the monitoring requirement in 179 NAC 3-005.02 item 1. If the Director grants the waiver, the system owner is not required to monitor.

3. Basis of an Asbestos Waiver: The director may grant a waiver based on a consideration of the following factors:

    a. Potential asbestos contamination of the water source, and
    b. The use of asbestos-cement pipe for finished water distribution and the corrosive nature of the water.

4. Effect of an Asbestos Waiver: A waiver remains in effect until the completion of the three-year compliance period. Systems not receiving a waiver must monitor in accordance with the provisions of 179 NAC 3-005.02 item 1.

5. Distribution System Vulnerable to Asbestos Contamination: A system vulnerable to asbestos contamination due solely to corrosion of asbestos-cement pipe must take one sample at a tap served by asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

6. Source Water Vulnerable to Asbestos Contamination: A system vulnerable to asbestos contamination due solely to source water must monitor in accordance with the provisions of 179 NAC 3-005.01.

7. Combined Asbestos Vulnerability: A system vulnerable to asbestos contamination due both to its source water and corrosion of asbestos-cement pipe must take one sample at a tap served by asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

8. Exceedance of the Asbestos MCL: A system which exceeds the maximum contaminant levels as determined in 179 NAC 3-005.01 item 4.a. must monitor quarterly beginning in the next quarter after the violation occurred.

9. Asbestos Reliably and Consistently Below the MCL: The Director may decrease the quarterly monitoring requirement to the frequency specified in 179 NAC 3-005.02 item 1 provided the Director has determined that the system is reliably and consistently below the maximum contaminant level. In no case will the Director make this determination unless a ground water system takes a minimum of two quarterly samples and a surface (or combined surface/ground) water system takes a minimum of four quarterly samples.

10. Grandfathered Asbestos Data: If monitoring data collected after January 1, 1990 are generally consistent with the requirements of 179 NAC 3-005.02, then the Director may allow systems to use that data to satisfy the monitoring requirement for the initial compliance period which ends December 31, 1995.

3-005.03 Monitoring for Inorganic Chemicals (Except Asbestos, Nitrate, and Nitrite): The frequency of monitoring conducted to determine compliance with the maximum contaminant levels in 179 NAC 2-002.04A for antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, and thallium is as follows.

1. Owners of ground water sources must take one sample at each sampling point during each compliance period. Owners of surface water sources or combined (surface/ground) must take one sample annually at each sampling point.

2. Monitoring Waivers: The owner of a system may apply to the Director for a waiver from the monitoring frequencies specified in 179 NAC 3-005.03 item 1.

3. Monitoring During a Waiver: As a condition of the waiver, the system owner must take a minimum of one sample while the waiver is effective. The term during which the waiver is effective must not exceed one compliance cycle (i.e., nine years).

4. Basis of a Waiver and Grandfathered Data: The Director may grant a waiver provided a surface water system has monitored annually for at least three years and a ground water system has monitored for a minimum of three rounds. (At least one sample must have been taken since January 1, 1990.) Owners of both surface and ground water systems must demonstrate that all previous analytical results were less than the maximum contaminant level. Systems that use a new water source are not eligible for a waiver until three rounds of monitoring from the new source have been completed.

5. In determining the appropriate reduced monitoring frequency, the Director will consider:

    a. Reported concentrations from all previous monitoring;
    b. The degree of variation in reported concentrations; and
    c. Other factors which may affect contaminant concentrations such as changes in ground water pumping rates, changes in the system's configuration, changes in the system's operating procedures, or changes in stream flows or characteristics.

6. A decision by the Director to grant a waiver will be made in writing and will set forth the basis for the determination. The determination may be initiated by the Director or upon an application by the public water system owner. The public water system owner must specify the basis for its request. The Director may review and, where appropriate, revise its determination of the appropriate monitoring frequency when the system owner submits new monitoring data or when other data relevant to the system's appropriate monitoring frequency become available.

7. Exceedance of an MCL: Entry points which exceed the maximum contaminant levels as calculated in 179 NAC 3-005.09 must monitor quarterly beginning in the next quarter after the violation occurred.

8. Reliably and Consistently Below the MCL: The Director may decrease the quarterly monitoring requirement to the frequencies specified in 179 NAC 3-005.03 items 1 and 2 provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case will the Director make this determination unless a ground water system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.

9. All new systems or systems that use a new source of water that begin operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the Director. The system must also comply with the initial sampling frequencies specified by the Director to ensure a system can demonstrate compliance with the MCL. Routine and increased monitoring frequencies must be conducted in accordance with the requirements in 179 NAC 3-005.

3-005.04 Monitoring Requirements for Nitrate: The owners of all public water systems (community; non-transient, non-community; and transient, non-community systems) must monitor to determine compliance with the maximum contaminant levels for nitrate.

3-005.04A Base Nitrate Sampling: Owners of community and non-transient, non-community water systems must monitor for nitrate as follows. Ground water entry points must be monitored annually beginning January 1, 1995 except as required in 179 NAC 3-005.04E; surface water entry points must be monitored quarterly beginning January 1, 1995.

3-005.04B Increased Nitrate Sampling Frequency: For community and non-transient non-community water systems; the monitoring frequency for ground water entry points must be quarterly following any one sample in which the concentration is greater than or equal to 5.0 milligrams per liter of nitrate as nitrogen. The monitoring frequency will reduce to annual after four consecutive quarterly samples are reliably and consistently less than the MCL except as required in 179 NAC 3-005.04E. In this case, annual monitoring must be done during the quarter which previously resulted in the highest analytical result.

3-005.04C Surface Water Reduced Nitrate Sampling Frequency: For community and non-transient, non-community water systems; the monitoring of surface water entry points will be reduced to annual if all analytical results from four consecutive

quarters are less than 5.0 mg/L (as nitrogen) except as required in 179 NAC 3-005.04E. In this case, annual monitoring must be done during a quarter which previously resulted in the highest analytical result. Surface water entry points will return to quarterly monitoring if any one sample is greater than or equal to 5.0 mg/L (as nitrogen).

3-005.04D Nitrate Monitoring of Transient, Non-Community Systems: The owner of each transient, non-community water system must monitor annually for nitrate beginning January 1, 1995 except as required in 179 NAC 3-005.04E.

3-005.04E If water prior to treatment exceeds the nitrate MCL and the water is treated to reduce the nitrate concentration, then the owner of the treatment system, regardless of the type of system, must monitor the treated water on a quarterly basis.

3-005.05 Monitoring Requirements for Nitrite: The owners of all public water systems (community; non-transient, non-community; and transient, non-community systems) must monitor to determine compliance with the maximum contaminant level for nitrite in 179 NAC 2-002.04A.

1. Monitoring must be conducted at the same time and frequency as required for nitrate in 179 NAC 3-005.04 unless the requirement under 179 NAC 3-005.05 item 2 would cause monitoring to be more frequent than required under 179 NAC 3-005.04.

2. For community; non-transient, non-community; and transient, non-community water systems; the increased monitoring frequency for any entry point must be quarterly for at least one year following any one sample in which the concentration is greater than or equal to 0.5 mg/L nitrite (as nitrogen). The sampling frequency will reduce to annual after the Director has determined that the entry point is reliably and consistently below the MCL. In such case, each subsequent sample must be taken during the quarter which previously resulted in the highest nitrite result.

3-005.06 Confirmation Samples

3-005.06A Where the results of sampling for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, or thallium indicate an exceedance of the maximum contaminant level, the system owner must collect a confirmation sample at the same sampling point within two weeks of the system owner's receipt of notification of the analytical results of the first sample.

3-005.06B Where nitrate or nitrite sampling results indicate an exceedance of the maximum contaminant level, the system owner must take a confirmation sample within 24 hours of the system owner's receipt of notification of the analytical results of the first sample. System owners unable to comply with the 24-hour sampling requirement must immediately notify persons served by the public water system in accordance with 179 NAC 4-004 and meet other Tier 1 public notification requirements under 179 NAC 4. Systems exercising this option must take and

analyze a confirmation sample within two weeks of notification of the analytical results of the first sample.

3-005.06C If a confirmation sample is taken for any contaminant as required by 179 NAC 3-005.06, then the results of the initial and confirmation sample will be averaged. The resulting average will be used to determine the system's compliance in accordance with 179 NAC 3-005.09. The Director has the discretion to delete results of obvious sampling errors.

3-005.07 Director's Designation of Increased Sampling Frequency: The Director may require more frequent monitoring than specified in 179 NAC 3-005.02 through 3-005.05 or may require confirmation samples for positive and negative results at his/her discretion.

3-005.08 Public water systems may apply to the Director to conduct more frequent monitoring than the minimum monitoring frequencies specified.

3-005.09 Compliance Calculations: Compliance with 179 NAC 2-002.04A must be determined based on the analytical result(s) obtained at each sampling point.

3-005.09A Sampling More Frequently Than Once Per Year: For entry points at which monitoring is conducted more frequently than once per year, compliance with the maximum contaminant levels for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, or thallium is determined by a running annual average at each sampling point. If the average at any sampling point is greater than the MCL, then the system is out of compliance. If any one sample would cause the annual average to be exceeded, then the system is out of compliance immediately. Any sample below the method detection limit will be calculated at zero for the purpose of determining the annual average. If a system fails to collect the required number of samples, compliance (average concentration) will be based on the total number of samples collected.

3-005.09B Sampling Once Per Year Or Less Frequently: For entry points at which monitoring is conducted annually or less frequently, the system is out of compliance with the maximum contaminant levels for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium, or thallium if the level of a contaminant is greater than the MCL. If confirmation samples are required by the Director, the determination of compliance will be based on the annual average of the initial MCL exceedance and any Director required confirmation samples. If a system fails to collect the required number of samples, compliance (average concentration) will be based on the total number of samples collected.

3-005.09C Compliance Calculations for Nitrate and Nitrite: Compliance with the maximum contaminant levels for nitrate and nitrite is determined based on one sample if the levels of these contaminants are below the MCLs. If the levels of nitrate or nitrite exceed the MCLs in a sample, a confirmation sample is required in accordance with 179 NAC 3-005.06B, and compliance will be determined based on the average of the initial and confirmation samples. If a confirmation sample is not collected within two weeks, as required in 179 NAC 3-005.06B, the determination of compliance will be based on the one sample result.

3-005.09D Arsenic sampling results will be reported to the nearest 0.001 mg/L as of January 23, 2006.

3-005.10 State Designated Sampling Schedules: Each public water system owner must monitor at the time designated by the Director during each compliance period.

3-005.11 Analytical Methods for Inorganic Analysis

3-005.11A Analysis for the following contaminants must be conducted in accordance with the methods in the following table, or their equivalent, as determined by EPA. The following methods are incorporated herein by reference. Criteria for analyzing arsenic, barium, beryllium, cadmium, calcium, chromium, copper, lead, nickel, selenium, sodium, and thallium with digestion or directly without digestion, and other analytical test procedures are contained in *Technical Notes on Drinking Water Methods*, EPA-600/R-94-173, October 1994, which is incorporated herein by reference. This document also contains approved analytical test methods which were available for compliance monitoring until July 1, 1996. Those methods were not available for use after July 1, 1996. This document is available from the National Technical Information Service, NTIS PB95-104766, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll-free number is 800-553-6847. Copies of the documents may be obtained from the sources listed in the footnotes. Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at 800-426-4791. These documents may be inspected at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509.

Contaminant and Methodology[13]	**EPA**	**ASTM[3]**	**SM[4] (18th, 19th ed)**	**SM[4] (20th ed**	**SM (online[22])**	**Other[12]**
1. Alkalinity:						
Titrimetric	----	D 1067-92, 02 B	2320 B	2320 B	2320 B-97	
Electrometric titration						I-1030-85[5]
2. Antimony:						
Inductively Coupled Plasma (ICP) -Mass Spectrometry	200.8[2]					
Hydride-Atomic Absorption		D 3697-92, 02			----	
Atomic Absorption; Platform	200.9[2]				----	
Atomic Absorption; Furnace			3113 B		3113 B-99	
3. Arsenic[14]						
Inductively Coupled Plasma[15]	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Furnace		D 2972-97, 03 C	3113 B		3113 B-99	
Hydride Atomic Absorption		D 1972-97, 03 B	3114 B		3114 B-97	
4. Asbestos:						
Transmission Electron Microscopy	100.1[9]					
Transmission Electron Microscopy	100.2[10]					
5. Barium:						
Inductively Coupled Plasma	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Direct			3111 D		3111 D-99	
Atomic Absorption; Furnace			3113 B		3113 B-99	
6. Beryllium:						
Inductively Coupled Plasma	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Furnace		D 3645-97, 03 B	3113 B	3113 B-99		
7. Cadmium:						
Inductively Coupled Plasma	200.7[2]					
ICP-Mass Spectrometry	200.8[2]					

Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Furnace			3113 B		3113 B-99	
8. Calcium:						
EDTA titrimetric	-----	D 511-93, 03 A	3500-Ca D	3500 Ca B	3500 Ca B-97	
Atomic Absorption; direct aspiration	-----	D 511-93, 03 B	3111 B		3111 B-99	
Inductively-coupled plasma	200.7[2]		3120 B	3120 B	3120 B-99	
Ion Chromatography		D6919-03				
9. Chromium						
Inductively Coupled Plasma	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Furnace			3113 B		3113 B-99	
10. Copper						
Atomic absorption; furnace	-----	D 1688-95, 02 C	3113 B		3113 B-99	
Atomic absorption; direct aspiration	-----	D 1688-95, 02 A	3111B		3111 B-99	
Inductively Coupled Plasma	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass spectrometry	200.8[2]					
Atomic absorption; platform	200.9[2]					
11. Conductivity Conductance		D 1125-95 (Re-approved 1999) A	2510 B	2510 B	2510 B-97	
12. Cyanide						
Manual Distillation followed by	-----	D 2036-98A	4500-CN-C	4500-CN-C		
Spectrophotometric, Amenable	-----	D 2036-98B	4500-CN-G	4500-CN-G	4500-CN G-99	
Spectrophotometric, Manual	-----	D 2036-98A	4500-CN-E	4500-CN-E	4500-CN E-99	I-3300-85[5]
Spectrophotometric, Semiautomated	335.4[6]					
Selective Electrode			4500-CN-F	4500-CN-F	4500-CN F-99	
UV/Distillation/Spectrophotometric						Kelada 01[17]
Micro Distillation, Flow Injection, Spectrophotometric						QuikChem 10-204-00-1-X[18]
Ligand Exchange and Amperometry[21]		D 6888-04				OIA-1677, DW[20]
13. Fluoride:						
Ion Chromatography	300.0[6] 300.1[19]	D 4327-97, 03	4110 B	4110 B	4110 B-00	
Manual Distill.; Color. SPADNS	-----		4500-F-B,D	4500-F-B,D	4500-F B, D-97	
Manual Electrode	-----	D 1179-93, 99 B	4500-F-C	4500-F-C	4500-F C-97	
Automated Electrode						380-75WE[11]
Automated Alizarin			4500-F-E	4500-F-E	4500-F E-97	129-71W[11]
Capillary Ion Electrophoresis						D6508, Rev. 2[23]
14. Lead:						
Atomic Absorption; furnace	-----	D 3559-96, 03D	3113 B		3113 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; platform	200.9[2]					
Differential Pulse Anodic Stripping Voltammetry			-----			Method 1001[16]
15. Magnesium:						
Atomic Absorption	-----	D 511-93, 03 B	3111B		3111 B-99	
ICP	200.7[2]		3120 B	3120 B	3120 B-99	
Complexation Titrimetric Methods	-----	D 511-93, 03 A	3500-Mg-E	3500-Mg-B	3500-Mg B-97	
Ion Chromatography		D 6919-03				
16. Mercury						
Manual, Cold Vapor	245.1[2]	D 3223-97, 02	3112 B		3112 B-99	
Automated, Cold Vapor	245.2[1]					
ICP-Mass Spectrometry	200.8[2]					
17. Nickel:						
Inductively Coupled Plasma	200.7[2]		3120 B	3120 B	3120 B-99	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Direct			3111 B		3111 B-99	
Atomic Absorption; Furnace			3113 B		3113 B-99	
18. Nitrate:						
Ion Chromatography	300.0[6] 300.1[19]	D 4327-97, 03	4110 B	4110 B	4110 B-00	B-1011[8]
Automated Cadmium Reduction	353.2[6]	D 3867-90A	4500-NO_3-F	4500-NO_3-F	4500-NO_3 F-00	
Ion Selective Electrode	-----		4500-NO_3-D	4500-NO_3-D	4500-NO_3 D-00	601[7]
Manual Cadmium Reduction		D 3867-90B	4500-NO_3-E	4500-NO_3-E	4500-NO_3 E-00	

Capillary Ion Electrophoresis						D6508, Rev.2[23]
19. Nitrite:						
Ion Chromatography	300.0[6] 300.1[19]	D 4327-97, 03	4110 B	4110 B	4110 B-00	B-1011[8]
Automated Cadmium Reduction	353.2[6]	D 3867-90A	4500-NO_3-F	4500-NO_3-F	4500-NO_3 F-00	
Manual Cadmium Reduction	-----	D 3867-90B	4500-NO_3-E	4500-NO_3-E	4500-NO_3 E-00	
Spectrophotometric	-----		4500-NO_2-B	4500-NO_2-B	4500-NO_2 B-00	
Capillary Ion Electrophoresis						D6508, Rev. 2[23]
20. Orthophosphate:[12]						
Colorimetric, automated, ascorbic acid	365.1[6]		4500-P F	4500-P F		
Colorimetric, ascorbic acid, single reagent	-----	D 515-88A	4500-P E	4500-P E		
Colorimetric, phosphomolybdate; automated-segmented flow; automated discrete						I-1601-85[5] I-2601-90[5] I-2598-85[5]
Ion Chromotography	300.0[6]	D 4327-97, 03	4110 B	4110 B	4110 B-00	
Capillary Ion Electrophoresis						D6508, Rev. 2[23]
21. pH: Electrometric	150.1 150.2[1]	D 1293-95, 99	4500-H^+ B	4500-H^+ B	4500-H^+B-00	
22. Selenium						
Hydride-Atomic Absorption		D 3859-98A, 03 A	3114 B		3114 B-97	
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					
Atomic Absorption; Furnace		D 3859-98, 03 B	3113 B		3113 B-99	
23. Silica:						
Colorimetric, molybdate blue; automated-segmented flow						I-1700-85[5] I-2700-85[5]
Colorimetric		D 859-95, 00				
Molybdosilicate			4500-Si D	4500-SiO_2 C	4500-SiO_2 C-97	
Heteropoly blue			4500-Si E	4500-SiO_2 D	4500-SiO_2 D-97	
Automated method for molybdate-reactive silica			4500-Si F	4500-SiO_2 E	4500-SiO_2 E-97	
Inductively-coupled plasma	200.7[2]		3120 B	3120 B	3120 B-99	
24. Sodium:						
Inductively coupled plasma	200.7[2]					
Atomic Absorption; direct aspiration			3111 B		3111 B-99	
Ion Chromatography		D6919-03				
25. Temperature: Thermometric			2550	2550	2550-00	
26. Thallium:						
ICP-Mass Spectrometry	200.8[2]					
Atomic Absorption; Platform	200.9[2]					

The procedures must be done in accordance with the documents listed below which are hereby incorporated by reference. Copies of the documents may be obtained from the sources listed below. Documents may be inspected at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509.

[1] "Methods for Chemical Analysis of Water and Wastes," March 1983, EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268. EPA-600/4-79/020. Available at NTIS, PB84-128677.

[2] "Methods for the Determination of Metals in Environmental Samples--Supplement I", EPA/600/R-94/111, May 1994. Available at NTIS, PB95-125472.

[3] *Annual Book of ASTM Standards*, 1994, 1996, 1999, or 2003, Vols 11.01 and 11.02, ASTM International; any year containing the cited version of the method may be used. The previous versions of D1688-95A, D1688-95C (copper), D3559-95D (lead), D1293-95 (pH), D1125-91A (conductivity) and D859-94 (silica) are also approved. These previous versions D1688-90A, C; D3559-90D, D1293-84, D1125-91A and D859-88, respectively are located in the *Annual Book of ASTM Standards*, 1994, Vol. 11.01. Copyrighted and available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, Phone 215-299-5585, FAX 215-977-9679.

[4] *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), or 20th edition (1998). The cited methods published in any of these three editions may be used, except that the versions of 3111 B, 3111 D, 3113 B, and 3114 B in the 20th edition may not be used. Available from the American Public Health Association, 1015 Fifteenth Street NW, Washington, DC 20005 and from American Water Works Association, Phone 800-926-7337, FAX 303-795-1989, HSL0017.

[5] Method I-2601-90, Methods for Analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of Inorganic and Organic Constituents in Water and Fluvial Sediment, Open File Report 93-125, 1993. For Methods I-1030-85; I-1601-85; I-1700-85; I-2598-85; I-2700-85; and I-3300-85, see Techniques of Water Resources Investigations of the U.S. Geological Survey, Book 5, Chapter A-1, 3rd ed., 1989; Available from Information Services, U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225-0425.

[6] "Methods for the Determination of Inorganic Substances in Environmental Samples," EPA/600/R-93/100, August 1993. Available at NTIS, PB94-120821, 5285 Port Royal Road, Springfield, VA 22161. The toll free telephone number is 800-553-6847.

[7] The procedure must be done in accordance with the Technical Bulletin 601 "Standard Method of Test for Nitrate in Drinking Water," July 1994, PN 221890-001, Analytical Technology, Inc. Copies may be obtained from ATI Orion, 529 Main Street, Boston, MA 02129.

[8] Method B-1011, "Waters Test Method for Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography," August 1987. Copies may be obtained from Waters Corporation, Technical Services Division, 34 Maple Street, Milford, MA 01757, Telephone: 508-482-2131, Fax: 508-482-3625.

[9] Method 100.1 "Analytical Method For Determination of Asbestos Fibers in Water," EPA/600/4-83/043, EPA, September 1983. Available at NTIS, PB83-260471.

[10] Method 100.2 "Determination of Asbestos Structure Over 10-µm in Length in Drinking Water," EPA/600/R-94/134, June 1994. Available at NTIS, PB94-201902.

[11] Industrial Method No. 129-71W, "Fluoride in Water and Wastewater," December 1972 and Method No. 380-75WE, "Fluoride in Water and Wastewater," February 1976, Technicon Industrial Systems. Copies may be obtained from Bran & Luebbe, 1025 Busch Parkway, Buffalo Grove, IL 60089.

[12] Unfiltered, no digestion or hydrolysis.

[13] Because MDLs reported in EPA Methods 200.7 and 200.9 were determined using a 2X preconcentration step during sample digestion, MDLs determined when samples are analyzed by direct analysis (i.e., no sample digestion) will be higher. For direct analysis of cadmium by Method 200.7, sample preconcentration using pneumatic nebulization may be required to achieve lower detection limits. Preconcentration may also be required for direct analysis of antimony, lead, and thallium by Method 200.9; antimony and lead by Method 3113 B; and lead by Method D3559-90D unless multiple in-furnace depositions are made.

[14] If ultrasonic nebulization is used in the determination of arsenic by Method 200.8, the arsenic must be in the pentavalent state to provide uniform signal response. For direct analysis of arsenic with Method 200.8 using ultrasonic nebulization, samples and standards must contain one mg/L of sodium hypochlorite.

[15] Starting January 23, 2006, analytical methods using the ICP-AES technology, may not be used because the detection limits for these methods are 0.008 mg/L or higher. This restriction means that the two ICP-AES methods (EPA Method 200.7 and SM 3120 B) approved for use for the MCL of 0.05 mg/L may not be used for compliance determinations for the revised MCL of 0.010 mg/L. However, prior to January 23, 2006 systems may have compliance samples analyzed with these less sensitive methods.

[16] The description of Method Number 1001 for lead is available from Palintest, LTD, 21 Kenton Lands Road, P.O. Box 18395, Erlanger, KY 41018, or from the Hach Company, P.O. Box 389, Loveland, CO 80539.

[17] The description for the Kelada 01 Method, "Kelada Automated Test Methods for Total Cyanide, Acid Dissociable Cyanide, and Thiocyanate," Revision 1.2, August 2001, EPA #821-B-01-009 for cyanide is available from the National Technical Information Service (NTIS), PB 2001-108275, 5285 Port Royal Road, Springfield, VA 22161. The toll free telephone number is 800-553-6847. **Note**: A 450-W UV lamp may be used in this method instead of the 550-W lamp specified if it

provides performance within the quality control (QC) acceptance criteria of the method in a given instrument. Similarly, modified flow cell configurations and flow conditions may be used in the method, provided that the QC acceptance criteria are met.

[18] The description for the QuikChem Method 10-204-00-1-X, "Digestion and distillation of total cyanide in drinking and wastewaters using MICRO DIST and determination of cyanide by flow injection analysis," Revision 2.1, November 30, 2000 for cyanide is available from Lachat Instruments, 6645 W. Mill Rd., Milwaukee, WI 53218, USA. Phone: 414-358-4200.

[19.] "Methods for the Determination of Organic and Inorganic Compounds in Drinking Water," Vol. 1, EPA 815-R-00-014, August 2000. Available at NTIS, PB2000-106981.

[20.] Method OIA-1677, DW "Available Cyanide by Flow Injection, Ligand Exchange, and Amperometry," January 2004. EPA-821-R-04-001, Available from ALPKEM, A Division of OI Analytical, P.O. Box 9010, College Station, TX 77842-9010.

[21.] Sulfide levels below those detected using lead acetate paper may produce positive method interferences. Test samples using a more sensitive sulfide method to determine if a sulfide interference is present, and treat samples accordingly.

[22.] Standard Methods Online are available at http://www.standardmethods.org. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only online versions that may be used.

[23.] Method D6508, Rev. 2, "Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte," available from Waters Corp, 34 Maple St., Milford, MA 01757, Telephone: 508-482-2131, Fax: 508-482-3625.

3-005.11B Sample Collection for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, nitrate, nitrite, selenium, and thallium under 179 NAC 3-005.11 must be conducted using the sample preservation, container, and maximum holding time procedures specified in the following table.

Contaminant	**Preservative[1]**	**Container[2]**	**Time[3]**
Antimony	HNO_3	P or G	6 months
Arsenic	Conc HNO_3 to pH<2	P or G	6 months
Asbestos	4°C	P or G	48 hours[4]
Barium	HNO_3	P or G	6 months
Beryllium	HNO_3	P or G	6 months
Cadmium	HNO_3	P or G	6 months
Chromium	HNO_3	P or G	6 months
Cyanide	4°C, NaOH	P or G	14 days
Fluoride	None	P or G	1 month
Mercury	HNO_3	P or G	28 days
Nickel	HNO_3	P or G	6 months
Nitrate	4°C	P or G	48 hours[5]
Nitrate-Nitrite[6]	H_2SO_4	P or G	28 days
Nitrite	4°C	P or G	48 hours
Selenium	HNO_3	P or G	6 months
Thallium	HNO_3	P or G	6 months

[1]For cyanide determinations samples must be adjusted with sodium hydroxide to pH 12 at the time of collection. When chilling is indicated, the sample must be shipped and stored at 4°C or less. Acidification of nitrate or metals samples may be with a concentrated acid or a dilute (50% by volume) solution of the applicable concentrated acid. Acidification of samples for metals analysis is encouraged and allowed at the laboratory rather than at the time of sampling provided the shipping time and other instructions in Section 8.3 of EPA Methods 200.7 or 200.8 or 200.9 are followed.

[2]P = plastic, hard or soft; G = glass, hard or soft.

[3]In all cases, samples should be analyzed as soon after collection as possible. Follow additional (if any) information on preservation, containers or holding times that is specified in method.
[4]Instructions for containers, preservation procedures and holding times as specified in Method 100.2 must be adhered to for all compliance analyses including those conducted with Method 100.1
[5]If the sample is chlorinated, the holding time for an unacidified sample kept at 4°C is extended to 14 days.
[6]Nitrate-Nitrite refers to a measurement of total nitrate.

3-005.11C Analytical Methods for Arsenic: Analyses for arsenic must be conducted using the following methods, incorporated herein by reference: Method 206.2[1,6], Atomic Absorption Furnace Technique; or Method 206.3[1,6], or Method D 2972-93B[4,7], or Method 3500-AS-B[2,7], Atomic Absorption--Gaseous Hydride; or Method 206.4[1,6], or Method D 2972-93A[4,7], or Method 3500-AS-C[2,7], Spectrophotometric, Silver Diethyl-dithiocarbamate; or Method 200.7A[5,6], Inductively Coupled Plasma Technique.

[1]"Methods for Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/4-79-020), March 1983. For approved analytical procedures for metals, the technique applicable to total metals must be used.
[2]"Standard Methods for the Examination of Water and Wastewater," 18th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1992. Copyrighted and available from AWWA, Phone 800-926-7337, FAX 303-795-1989, HSL0017.
[3][Reserved]
[4]Annual Book of ASTM Standards, Vols. 11.01 and 11.02, 1994, American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103-1187. Copyrighted and available from ASTM, Phone 215-299-5585, FAX 215-977-9679.
[5]Appendix to EPA Method 200.7, March 1987.
[6]Methods are available upon request from the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, 3rd Floor, Lincoln, NE 68509, Phone 402-471-2541.
[7]Methods are copyrighted and available from the sources listed or methods may be viewed at Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509.

3-005.11D Analytical Methods for Fluoride: Analyses for fluoride must be conducted using the following methods, which are incorporated herein by reference.

	Reference (Method Number)			
Methodology	EPA[1,2]	ASTM[3,4]	SM[3,5]	Other
Colorimetric SPADNS, with distillation	340.1	D1179-93A	4500-F-A, B&D	--
Potentiometric ion selective electrode	340.2	D1179-93B	4500-F-C	--
Automated Alizarin fluoride blue, with distillation (complexone)	340.3		4500-F-E	--

[1]"Methods for Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/4-79-020), March 1983. For approved analytical procedures for metals, the technique applicable to total metals must be used.
[2]Methods are included in Attachment ~~2~~1.
[3]Methods are copyrighted and available from the sources listed OR methods may be viewed at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509.
[4]Annual Book of ASTM Standards, Vols. 11.01 and 11.02, 1994, American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103-1187. Copyrighted and available from ASTM, Phone 215-299-5585, FAX 215-977-9679.

[5]"*Standard Methods for the Examination of Water and Wastewater*," 18th Edition, American Public Health Association, American Water Works Association, Water Environment Federation, 1992. Copyrighted and available from AWWA, Phone 800-926-7337, FAX 303-795-1989, HLS0017.

3-005.11E Analysis under 179 NAC 3-005 must only be conducted by the Department Laboratory or other laboratories that have been approved by the Director in accordance with 179 NAC 3-009 and that have been certified by EPA or the Director. Laboratories may conduct sample analysis under provisional certification until January 1, 1996. To receive certification to conduct analyses for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, nitrate, nitrite, selenium and thallium, the laboratory must:

1. Analyze Performance Evaluation samples which include those substances provided by EPA Environmental Monitoring Systems Laboratory or equivalent samples provided by the Director at least once a year.

2. For each contaminant that has been included in the PE sample and for each method for which the laboratory desires certification, achieve quantitative results on the analyses that are within the following acceptance limits:

Contaminant	**Acceptance Limit**
Antimony	± 30% at ≥0.006 mg/L
Arsenic	± 30% at ≥0.003 mg/L effective January 23, 2006
Asbestos	2 standard deviations based on study statistics
Barium	± 15% at ≥0.15 mg/L
Beryllium	± 15% at ≥0.001 mg/L
Cadmium	± 20% at ≥0.002 mg/L
Chromium	± 15% at ≥0.01 mg/L
Cyanide	± 25% at ≥0.1 mg/L
Fluoride	± 10% at ≥1 to 10 mg/L
Mercury	± 30% at ≥0.0005 mg/L
Nickel	± 15% at ≥0.01 mg/L
Nitrate	± 10% at ≥0.4 mg/L
Nitrite	± 15% at ≥0.4 mg/L
Selenium	± 20% at ≥0.01 mg/L
Thallium	± 30% at ≥0.002 mg/L

3-005.12 If the result of an analysis made under 179 NAC 3-005 indicates that the level of arsenic exceeds the maximum contaminant level, the owner of the public water system must initiate three additional analyses at the sampling point within one month.

3-005.13 When the average of four analyses made pursuant to 179 NAC 3-005.12, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the owner of the system must notify the Department pursuant to 179 NAC 5 and give notice to the public pursuant to 179 NAC 4. Monitoring after public notification must be at a frequency designated by the Director and must continue until the maximum contaminant level has

not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action becomes effective.

3-005.14 The provisions of 179 NAC 3-005.12 and 3-005.13 notwithstanding, compliance with the maximum contaminant level for nitrate will be determined on the basis of the mean of two analyses. When a level exceeding the maximum contaminant level for nitrate is found, a second analysis must be initiated within 24 hours, and if the mean of the two analyses exceeds the maximum contaminant level, the supplier of water must report his findings to the Department pursuant to 179 NAC 5 and must notify the public pursuant to 179 NAC 4.

3-006 MONITORING REQUIREMENTS FOR DISINFECTION BYPRODUCTS

3-006.01 Monitoring requirements for disinfection byproducts are specified in 179 NAC 16-005.

3-007 ORGANIC CHEMICALS OTHER THAN DISINFECTION BYPRODUCTS SAMPLING AND ANALYTICAL REQUIREMENTS

3-007.01 Analyses for the contaminants in 179 NAC 3-007 must be conducted using the following EPA methods or their equivalent as approved by EPA.

3-007.01A The following documents are incorporated herein by reference. Copies may be inspected at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE 68509. Method 508A and 515.1 are in *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88-039, December 1988, Revised July 1991. Methods 547, 550, and 550.1 are in *Methods for the Determination of Organic Compounds in Drinking Water--Supplement I,* EPA/600-4-90-020, July 1990. Methods 548.1, 549.1, 552.1, and 555 are in *Methods for the Determination of Organic Compounds in Drinking Water--Supplement II*, EPA/600/R-92-129, August 1992. Methods 502.2, 504.1, 505, 506, 507, 508, 508.1, 515.2, 524.2, 525.2, 531.1, 551.1 and 552.2 are in *Methods for the Determination of Organic Compounds in Drinking Water--Supplement III*, EPA/600/R-95-131, August 1995. Method 1613 is titled "Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope-Dilution HRGC/HRMS", EPA/821-B-94-005, October 1994. These documents are available from the National Technical Information Service, NTIS PB91-231480, PB91-146027, PB92-207703, PB95-261616 and PB95-104774, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll-free number is 800-553-6847. Method 6651 must be followed in accordance with *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), or 20th edition (1998), American Public Health Association (APHA); any one of these three editions may be used. Method 6610 must be followed in accordance with *18th edition of Standard Methods for the Examination of Water and Wastewater*, (18th Edition Supplement) (1994) or with the 19th edition (1995) or 20th edition (1998) of *Standard Methods for the Examination of Water and Wastewater*, any of these publications may be used. The APHA documents are available from APHA, 1015 Fifteenth Street NW, Washington, D.C. 20005. Other required analytical test procedures germane to the conduct of these analyses are contained in *Technical Notes on Drinking Water Methods*, EPA/600/R-94-173, October 1994, NTIS PB95-104766. EPA Methods 515.3 and 549.2 are available from U.S. Environmental

Protection Agency, National Exposure Research Laboratory (NERL)-Cincinnati, 26 West Martin Luther King Drive, Cincinnati, OH 45268. ASTM Method D 5317-93, 98 (reapproved 2003) is available in the *Annual Book of ASTM Standards*, 1999, Vol. 11.02, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428, any edition containing the cited version of the method may be used. EPA Method 515.4, "Determination of Chlorinated Acids in Drinking Water by Liquid-Liquid Microextraction, Derivatization and Fast Gas Chromatography with Electron Capture Detection," Revision 1.0, April 2000, EPA/815/B-00/001 and EPA Method 552.3, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Microextraction, Derivatization, and Gas Chromatography with Electron Capture Detection," Revision 1.0, July 2003, EPA 815-B-03-002, can be accessed and downloaded directly on-line at http://www.epa.gov/safewater/methods/sourcalt.html. Syngenta Method AG-625, "Atrazine in Drinking Water by Immunoassay," February 2001 is available from Syngenta Crop Protection, Inc., 410 Swing Road, P. O. Box 18300, Greensboro, NC 27419, phone number (336) 632-6000. Method 531.2 "Measurement of N-methylcarbamoyloximes and N-methylcarbamates in Water by Direct Aqueous Injection HPLC with Postcolumn Derivatization," Revision 1.0, September 2001, EPA 815/B-01/002 can be accessed and downloaded directly on-line at www.epa.gov/safewater/methods/sourcalt.html.

Contaminant	**EPA Method**	**Standard Methods**	**ASTM**	**Other**
Benzene	502.2, 524.2			
Carbon tetrachloride	502.2, 524.2, 551.1			
Chlorobenzene	502.2, 524.2			
1,2-Dichlorobenzene	502.2, 524.2			
1,4-Dichlorobenzene	502.2, 524.2			
1,2-Dichloroethane	502.2, 524.2			
cis-Dichloroethylene	502.2, 524.2			
trans-Dichloroethylene	502.2, 524.2			
Dichloromethane	502.2, 524.2			
1,2-Dichloropropane	502.2, 524.2			
Ethylbenzene	502.2, 524.2			
Styrene	502.2, 524.2			
Tetrachloroethylene	502.2, 524.2, 551.1			
1,1,1-Trichloroethane	502.2, 524.2, 551.1			
Trichloroethylene	502.2, 524.2, 551.1			
Toluene	502.2, 524.2			
1,2,4-Trichlorobenzene	502.2, 524.2			
1,1-Dichloroethylene	502.2, 524.2			
1,1,2-Trichloroethane	502.2, 524.2, 551.1			
Vinyl chloride	502.2, 524.2			
Xylenes (total)	502.2, 524.2			
2,3,7,8-TCDD (dioxin)	1613			
2,4-D[4] (as acids, salts and esters)	515.2, 555, 515.1, 515.3, 515.4		D5317-93, 98 (Reapproved 2003)	

Contaminant	**EPA Method**	**Standard Methods**	**ASTM**	**Other**
2,4,5-TP[4] (Silvex)	515.2, 555, 515.1, 515.3, 515.4		D5317-93, 98 (Reapproved 2003)	
Alachlor[2]	507, 525.2, 508.1, 505, 551.1			
Atrazine[2]	507, 525.2, 508.1, 505, 551.1			Syngenta[5] AG-625
Benzo(a)pyrene	525.2, 550, 550.1			
Carbofuran	531.1, 531.2	6610		
Chlordane	508, 525.2, 508.1, 505			
Dalapon	552.1, 515.1, 552.2, 515.3, 515.4, 552.3			
Di(2-ethylhexyl)adipate	506, 525.2			
Di(2-ethylhexyl)phthalate	506, 525.2			
Dibromochloropropane (DBCP)	504.1, 551.1			
Dinoseb[4]	515.2, 555, 515.1, 515.3, 515.4			
Diquat	549.2			
Endothall	548.1			
Endrin	508, 525.2, 508.1, 505, 551.1			
Ethylene dibromide (EDB)	504.1, 551.1			
Glyphosate	547	6651		
Heptachlor	508, 525.2, 508.1, 505, 551.1			
Heptachlor Epoxide	508, 525.2, 508.1, 505, 551.1			
Hexachlorobenzene	508, 525.2, 508.1, 505, 551.1			
Hexachlorocyclopentadiene	508, 525.2, 508.1, 505, 551.1			
Lindane	508, 525.2, 508.1, 505, 551.1			
Methoxychlor	508, 525.2, 508.1, 505, 551.1			
Oxamyl	531.1, 531.2	6610		
PCBs[3] (as decachlorobiphenyl) (as Aroclors)	508A 508.1, 508, 525.2, 505			
Pentachlorophenol	515.2, 525.2, 555, 515.1, 515.3, 515.4		D5317-93, 98 (Reapproved 2003)	

Contaminant	**EPA Method**	**Standard Methods**	**ASTM**	**Other**
Picloram[4]	515.2, 555, 515.1, 515.3, 515.4		D5317-93, 98 (Reapproved 2003)	
Simazine[2]	507, 525.2, 508.1, 505, 551.1			
Toxaphene	508, 508.1, 525.2, 505			
Total Trihalomethanes	502.2, 524.2, 551.1			

[1]Reserved.
[2]Substitution of the detector specified in Method 505, 507, 508 or 508.1 for the purpose of achieving lower detection limits is allowed as follows: Either an electron capture or nitrogen phosphorous detector may be used provided all regulatory requirements and quality control criteria are met.
[3]PCBs are qualitatively identified as Aroclors and measured for compliance purposes as decachlorobiphenyl. Users of Method 505 may have more difficulty in achieving the required detection limits than users of Methods 508.1, 525.2, or 508.
[4]Accurate determination of the chlorinated esters requires hydrolysis of the sample as described in EPA Methods 515.1, 515.2, 515.3, 515.4, and 555, and ASTM Method D 5317-93, 98 (Reapproved 2003).
[5]This method may not be used for the analysis of atrazine in any system where chlorine dioxide is used for drinking water treatment. In samples from all other systems, any result for atrazine generated by Method AG-625 that is greater than one-half the maximum contaminant level (MCL) (in other words, greater than 0.0015 mg/L or 1.5µg/L) must be confirmed using another approved method for this contaminant and should use additional volume of the original sample collected for compliance monitoring. In instances where a result from Method AG-625 triggers such confirmatory testing, the confirmatory result is to be used to determine compliance.

3-007.02 Monitoring Requirements: Monitoring for the contaminants listed in 179 NAC 2-002.04B1 (VOC) for purposes of determining compliance with the maximum contaminant levels must be conducted as follows.

3-007.02A Ground Water Sources: Ground water sources must be monitored at every entry point to the distribution system which is representative of each ground water source after treatment (hereafter called a sampling point or entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

3-007.02B Surface Water Sources: Surface water sources (or combined surface/ground water sources) must take a minimum of one sample at points in the distribution system that are representative of each source or at each entry point to the distribution system after treatment (hereafter called a sampling point or entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source, treatment plant, or within the distribution system.

3-007.02C Multiple Sources: If an entry point represents more than one source and the sources are combined before distribution, the system owner must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water representative of all sources is being used).

3-007.02D Monitoring Frequency: Each community and non-transient, non-community water system must take four consecutive quarterly samples for each contaminant listed in 179 NAC 2-002.04B during each compliance period, beginning in the initial compliance period.

3-007.02E If No Contaminant Is Detected: If the initial monitoring for contaminants listed in 179 NAC 2-002.04B1 (1) through (8) and the monitoring for the contaminants listed in 179 NAC 2-002.04B1 (9) through (21) was completed by December 31, 1992, and the system did not detect any contaminant listed in 179 NAC 2-002.04B1 (1) through (21), then each ground and surface water system must take one sample annually beginning with the initial compliance period.

3-007.02F Reduced VOC Monitoring: After a minimum of three years of annual sampling, the Director may allow ground water systems with no previous detection of any contaminant listed in 179 NAC 2-002.04B1 to take one sample during each compliance period.

3-007.02G Waiver: The owner of each community and non-transient, non-community ground water entry point, at which no contaminant listed in 179 NAC 2-002.04B1 is detected, may apply to the Director for a waiver from the requirements of 179 NAC 3-007.02E and 3-007.02F after completing the initial monitoring. (For the purposes of 179 NAC 3-007.02G, detection is defined as ≥0.0005 mg/L.) A waiver will be effective for no more than six years (two compliance periods). The Director may also issue waivers to small systems for the initial round of monitoring for 1,2,4-trichlorobenzene.

3-007.02H Bases of a Sampling Waiver: The Director may grant a waiver after evaluating the following factor(s):

1. Knowledge of previous use (including transport, storage, or disposal) of the contaminant within the watershed or zone of influence of the system. If a determination by the Director reveals no previous use of the contaminant within the watershed or zone of influence, a waiver may be granted.
2. If previous use of the contaminant is unknown or it has been used previously, then the following factors must be used to determine whether a waiver is granted:

    a. Previous analytical results;
    b. The proximity of the sources for the entry point to a potential point or non-point source of contamination (point sources include spills and leaks of chemicals at or near a water treatment facility or at manufacturing, distribution, or storage facilities, or from hazardous and municipal waste landfills and other waste handling or treatment facilities);
    c. The environmental persistence and transport of the contaminants;
    d. The number of individuals served by the public water system and the proximity of a small system to a larger system;
    e. How well the water source is protected against contamination, such as whether it is a surface or ground water system. (For ground water sources, the Director will consider factors such as depth of the well, the type of soil, and wellhead protection. For

surface water sources, the Director will consider watershed protection.)

3-007.02I As a condition of the waiver, the owner of a ground water system must take one sample at an entry point which received a waiver during the time the waiver is effective (i.e., one sample during two compliance periods or six years) and update its vulnerability assessment considering the factors listed in 179 NAC 3-007.02H. Based on this vulnerability assessment, the Director will reconfirm that the entry point is non-vulnerable. If the Director does not make this reconfirmation within three years of the initial determination, then the waiver is invalidated.

3-007.02J The owner of each community and non-transient, non-community surface water entry point, at which no contaminant listed in 179 NAC 2-002.04B1 is detected, may apply to the Director for a waiver from the requirements of 179 NAC 3-007.02E after monitoring at least one time. (For the purposes of this section, detection is defined as ≥0.0005 mg/L.) Composite samples from a maximum of five sampling points are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Entry points meeting this criterion must be determined by the Director to be non-vulnerable based on a vulnerability assessment during each compliance period. Each system receiving a waiver must sample at the frequency specified by the Director (if any).

3-007.02K If a contaminant in 179 NAC 2-002.04B1 (1) through (21) is detected at a level exceeding 0.0005 mg/L in any sample, for the first time, then:

1. The owner of the system must monitor quarterly at each sampling point which resulted in a detection.
2. The Director may decrease the quarterly monitoring requirement specified in 179 NAC 3-007.02K item 1 provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case will the Director make this determination unless a ground water system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.
3. If the Director determines that the system is reliably and consistently below the MCL, the Director may allow the system to monitor annually. Systems that monitor annually must monitor during the quarter(s) that previously yielded the highest analytical result.
4. Systems that have three consecutive annual samples with no detection of a contaminant may apply to the Director for a waiver as specified in 179 NAC 3-007.02G.
5. Vinyl Chloride Monitoring: Analysis for vinyl chloride is required only for ground water systems that have detected one or more of the following two-carbon organic compounds: Trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, or 1,1-dichloroethylene. The analysis for vinyl chloride is required at each distribution or entry point at which one or more of the two-carbon organic compounds were found. If the first analysis does not detect vinyl chloride, the Director may reduce the frequency of vinyl chloride monitoring to one every three years for that sample location or other sample locations which are more representative of the same source. Surface water

systems may be required to analyze for vinyl chloride at the discretion of the Director.

3-007.02L Entry points which violate the requirements of 179 NAC 2-002.04B1, as determined by 179 NAC 3-007.02O, must monitor quarterly. After a minimum of four consecutive quarterly samples which show the entry point is in compliance and the Director determines that the entry point is reliably and consistently below the maximum contaminant level, the owner of the entry point may monitor at the frequency and time specified in 179 NAC 3-007.02K item 3.

3-007.02M The Director may require confirmation samples for positive or negative results. If a confirmation sample(s) is required by the Director, then the sample result(s) must be averaged with the first sampling result and the average used for compliance determination in accordance with 179 NAC 3-007.02O. The Director has discretion to delete results of obvious sampling errors from this calculation.

3-007.02N Composite Samples: The Director may reduce the total number of samples a system must analyze by allowing the use of compositing. Composite samples from a maximum of five sampling points are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Compositing of samples is to be done in the laboratory by the procedures listed below. Samples must be analyzed within 14 days of collection.

1. If the concentration in the composite sample is greater than or equal to 0.0005 mg/L for any contaminant listed in 179 NAC 2-002.04B1, then a follow-up sample must be taken and analyzed within 14 days from each sampling point included in the composite.

2. If duplicates of the original sample taken from each sampling point used in the composite are available, the system owner may use these duplicates instead of resampling. The duplicate must be analyzed within 14 days of collection.

3. If the population served by the system is greater than 3,300 individuals, then compositing may only be permitted at sampling points within a single system. In systems serving less than or equal to 3,300 individuals, compositing among different systems is allowed provided the 5-sample limit is maintained.

4. Compositing Samples prior to GC Analysis

    a. Add 5 ml or equal larger amounts of each sample (up to 5 samples are allowed) to a 25 ml glass syringe. Special precautions must be made to maintain zero headspace in the syringe.
    b. The samples must be cooled at 4°C during this step to minimize volatilization losses.
    c. Mix well and draw out a 5-ml aliquot for analysis.
    d. Follow sample introduction, purging and desorption steps described in the method.
    e. If less than five samples are used for compositing, a proportionately smaller syringe may be used.

5. Compositing Samples Prior to GC/MS Analysis

a. Inject 5-ml or equal larger amounts of each aqueous sample (up to 5 samples are allowed) into a 25-ml purging device using the sample introduction technique described in the method.
b. The total volume of the sample in the purging device must be 25 ml.
c. Purge and desorb as described in the method.

3-007.02O Compliance Calculations: Compliance with the MCL in 179 NAC 2-002.04B1 will be determined based on the analytical results obtained at each sampling point. If one sampling point is in violation of an MCL, the system is in violation of the MCL.

1. For systems monitoring more than once per year, compliance with the MCL is determined by a running annual average at each sampling point.

2. Systems monitoring annually or less frequently whose sample result exceeds the MCL must begin quarterly sampling. The system will not be considered in violation of the MCL until it has completed one year of quarterly sampling.

3. If any sample result will cause the running annual average to exceed the MCL at any sampling point, the system is out of compliance with the MCL immediately.

4. If a system fails to collect the required number of samples, compliance will be based on the total number of samples collected.

5. If a sample result is less than the detection limit, zero will be used to calculate the annual average.

3-007.02P Certified and Approved Laboratories: Analysis under 179 NAC 3-007 must only be conducted by the Department of Health and Human Services Public Health Environmental Laboratory or other laboratories that are certified by the Department or EPA according to the following conditions.

1. To receive certification to conduct analyses for the contaminants in 179 NAC 2-002.04B1 (2) through (21), the laboratory must:

   a. Analyze Performance Evaluation (PE) samples which include these substances provided by EPA Environmental Monitoring and Support Laboratory or equivalent samples provided by the Director at least once a year by each method for which the lab desires certification.

   b. Achieve the following quantitative acceptance limits under 179 NAC 3-007.02P items 1.c. and 1.d. for at least 80% of the regulated organic chemicals included in the PE sample.

   c. Achieve quantitative results on the analyses performed under 179 NAC 3-007.02P item 1.a. that are within ±20% of the actual amount of the substances in the Performance Evaluation sample when the actual amount is greater than or equal to 0.010 mg/L.

d. Achieve quantitative results on the analyses performed under 179 NAC 3-007.02P item 1.a. that are within ±40% of the actual amount of the substances in the Performance Evaluation sample when the actual amount is less than 0.010 mg/L.

e. Achieve a method detection limit of 0.0005 mg/L, according to the procedures in Appendix B of Part 136 of the Code of Federal Regulations which is ~~incorporated by reference and attached hereto as Attachment 1.~~available for viewing at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South Lincoln, NE 68509, or from the U.S. Government Printing Office at http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR.

2. To receive certification to conduct analyses for vinyl chloride, the laboratory must:

a. Analyze Performance Evaluation (PE) samples provided by EPA Environmental Monitoring and Support Laboratory or equivalent samples provided by the Director at least once a year by each method for which the laboratory desires certification.

b. Achieve quantitative results on the analyses performed under 179 NAC 3-007.02P item 2.a. that are within ±40% of the actual amount of vinyl chloride in the Performance Evaluation sample.

c. Achieve a method detection limit of 0.0005 mg/L, according to the procedures in Appendix B of Part 136 of the Code of Federal Regulations which is available for viewing at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South Lincoln, NE 68509, or from the U.S. Government Printing Office at http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR. ~~incorporated by reference and attached hereto as Attachment 1~~.

d. Obtain certification for the contaminants listed in 179 NAC 2-002.04B1 (2) through (21).

3-007.02Q The Director may increase required monitoring where necessary to detect variations within the system.

3-007.02R Laboratory Certification: Each approved laboratory must determine the method detection limit (MDL), (as defined in Appendix B to Part 136 of the Code of Federal Regulations which is available for viewing at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South Lincoln, NE 68509, or from the U.S. Government Printing Office at http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR,~~incorporated by reference and attached hereto as Attachment 1)~~, at which it is capable of detecting VOCs. The acceptable MDL is 0.0005 mg/L. This concentration is the detection concentration for purposes of 179 NAC 3-007.

3-007.02S State Designated VOC Sampling Schedules: Each public water system owner must monitor at the time designated by the Director within each compliance period.

3-007.02T New Systems Or Sources: All new systems or systems that use a new source of water that begin operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the Director. The system must also comply with the initial sampling frequencies specified by the Director to ensure a system can demonstrate compliance with the MCL. Routine and increased monitoring frequencies must be conducted in accordance with the requirements in 179 NAC 3-007.

3-007.03 Monitoring Sites and Protocol: Analysis of the contaminants listed in 179 NAC 2-002.04B2 for the purposes of determining compliance with the maximum contaminant level must be conducted as follows:

1. Ground Water Sources: Ground water sources must be monitored at every entry point to the distribution system which is representative of each ground water source after treatment (hereafter called a sampling point or entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

2. Surface Water Sources: Surface water sources must be monitored at points in the distribution system that are representative of each source or at each entry point to the distribution system after treatment (hereafter called a sampling point or entry point). Each sample must be taken at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

   NOTE: For the purposes of 179 NAC 3-007.03 item 2, surface water systems include systems with a combination of surface and ground water sources.

3. Multiple Sources: If an entry point represents more than one source and the sources are combined before distribution, the system owner must sample at the entry point to the distribution system during periods of normal operating conditions (i.e., when water representative of all sources is being used).

4. Monitoring Frequency

   a. Initial Compliance Period Monitoring: Owners of each community and non-transient, non-community water system must take four consecutive quarterly samples during the three-year compliance period which ends December 31, 1995 for each contaminant listed in 179 NAC 2-002.04B2 during the compliance period which began January 1, 1996 and ended December 31, 1998.

   b. Repeat Compliance Period Monitoring: Systems serving more than 3,300 individuals that do not detect a contaminant in the initial compliance period may reduce the sampling frequency to a

minimum of two quarterly samples in one year during each repeat compliance period.

c. Systems serving less than or equal to 3,300 individuals that do not detect a contaminant in the initial compliance period may reduce the sampling frequency to a minimum of one sample during each repeat compliance period.

5. Waivers from Initial and Repeat Compliance Period Monitoring: A system owner may apply to the Director for a waiver from the requirements in 179 NAC 3-007.03 item 4. A system owner must reapply for a waiver for each compliance period.

6. The Director may grant a waiver after evaluating the following factor(s): Knowledge of previous use (including transport, storage, or disposal) of the contaminant within the watershed or zone of influence of the entry point source(s). If a determination by the Director reveals no previous use of the contaminant within the watershed or zone of influence, a waiver may be granted. If previous use of the contaminant is unknown or it has been used previously then the following factors will be used to determine whether a waiver is granted:

a. Previous analytical results.

b. The proximity of the entry point source(s) to a potential point or non-point source of contamination. Point sources include spills and leaks of chemicals at or near a water treatment facility or at manufacturing, distribution, or storage facilities, or from hazardous and municipal waste landfills and other waste handling or treatment facilities. Non-point sources include use of pesticides to control insect and weed pests on agricultural areas, forest lands, home and gardens, and other land application uses.

c. The environmental persistence and transport of the pesticide or PCBs.

d. How well the water source is protected against contamination due to such factors as depth of the well and the type of soil and the integrity of the well casing.

e. Elevated nitrate levels at the entry point source(s).

f. Use of PCBs in equipment used in the production, storage, or distribution of water (i.e., PCBs used in pumps, transformers, etc.).

7. If Detected: If an organic contaminant listed in 179 NAC 2-002.04B2 is detected (as defined by 179 NAC 3-007.03 item 17) in any sample, then:

a. The owner must monitor quarterly at each sampling point which resulted in a detection for each contaminant which was detected.

b. The Director may decrease the quarterly monitoring requirement specified in 179 NAC 3-007.03 item 7.a. provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case will the Director make this determination unless a ground water system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.

c. After the Director determines the system is reliably and consistently below the maximum contaminant level, the Director may allow the system to monitor annually. Systems that monitor annually must monitor during the quarter that previously yielded the highest analytical result.

d. Systems that have three consecutive annual samples with no detection of a contaminant may apply to the Director for a waiver as specified in 179 NAC 3-007.03 item 6.

e. If monitoring results in detection of one or more of certain related contaminants (aldicarb, aldicarb sulfone, aldicarb sulfoxide and heptachlor, heptachlor epoxide), then subsequent monitoring must analyze for all related contaminants.

8. MCL Violation and Reliably/Consistently Below the MCL: Entry points which violate an MCL in 179 NAC 2-002.04B2 as determined by 179 NAC 3-007.03 item 11 must monitor quarterly. After a minimum of four quarterly samples show the system is in compliance and the Director determines the entry point is reliably and consistently below the MCL, as specified in 179 NAC 3-007.03 item 11, the system owner must monitor the entry point at the frequency specified in 179 NAC 3-007.03 item 7.c.

9. Confirmation Sampling: The Director may require a confirmation sample for positive or negative results. If a confirmation sample is required by the Director, the result must be averaged with the first sampling result and the average used for the compliance determination as specified in 179 NAC 3-007.03 item 11. The Director has the discretion to delete results of obvious sampling errors from this calculation.

10. Composite Sampling: The Director may reduce the total number of samples a system must analyze by allowing the use of compositing. Composite samples from a maximum of five sampling points are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Compositing of samples must be done in the laboratory and analyzed within 14 days of sample collection.

a. If the concentration in the composite sample detects one or more contaminants listed in 179 NAC 2-002.04B2, then a follow-up

sample must be taken and analyzed within 14 days from each sampling point included in the composite.

b. If duplicates of the original sample taken from each sampling point used in the composite are available, the system may use these instead of resampling. The duplicates must be analyzed and the results reported to the Director within 14 days of collection.

c. If the population served by the system is greater than 3,300 individuals, compositing may only be permitted by the Director at sampling points within a single system. In systems serving less than or equal to 3,300 individuals, the Director may permit compositing among different systems provided the 5-sample limit is maintained.

11. Compliance Calculations: Compliance with 179 NAC 2-002.04B2 must be determined based on the analytical results obtained at each sampling point. If one sampling point is in violation of an MCL, the system is in violation of the MCL.

a. For systems monitoring more than once per year, compliance with the MCL is determined by a running annual average of all samples taken at each sampling point.

b. Systems monitoring annually or less frequently whose sample result exceeds the regulatory detection level as defined by 179 NAC 3-007 item 17 must begin quarterly sampling. The system will not be considered in violation of the MCL until it has completed one year of quarterly sampling.

c. If any sample result will cause the running annual average to exceed the MCL at any sampling point, the system is out of compliance with the MCL immediately.

d. If a system fails to collect the required number of samples, compliance will be based on the total number of samples collected.

e. If a sample result is less than the detection limit, zero will be used to calculate the annual average.

12. PCB Analysis: Analysis for PCBs must be conducted as follows using the methods in 179 NAC 3-007.01:

a. Each system owner who monitors for PCBs must analyze each sample using either Method 508.1, 525.2, 508 or 505. (Note: Users of Method 505 may have more difficulty in achieving the required Aroclor detection limits than users of Methods 508.1, 525.2 or 508.)

b. If PCBs (as one of seven Aroclors) are detected (as designated in 179 NAC 3-007.03 item 12.b.) in any sample analyzed using Methods 505 or 508, the system must reanalyze the sample using Method 508A to quantitate PCBs (as decachlorobiphenyl).

Aroclor	**Detection Limit (mg/L)**
1016	0.00008
1221	0.02
1232	0.0005
1242	0.0003
1248	0.0001
1254	0.0001
1260	0.0002

c. Compliance with the PCB MCL will be determined based upon the quantitative results of analyses using Method 508A.

13. Grandfathered Data: If monitoring data collected after January 1, 1990, are generally consistent with the requirements of 179 NAC 3-007.03, then the Director will allow owners of systems to use that data to satisfy the monitoring requirement for the initial compliance period.

14. Increased Sampling: The Director may increase the required monitoring frequency, where necessary, to detect variations within the system (e.g., fluctuations in concentration due to seasonal use, changes in water source).

15. State Enforcement: The Director has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by its sanctioned representatives and agencies.

16. Designated Sampling Schedules: Each public water system owner must monitor at the time designated by the Director within each compliance period.

17. Detection Limits: Detection as used in 179 NAC 3-007.03 item 17 is defined as greater than or equal to the following concentrations for each contaminant.

Contaminant	**Detection Limit (mg/L)**
Alachlor	0.0002
Aldicarb	0.0005
Aldicarb sulfoxide	0.0005
Aldicarb sulfone	0.0008
Atrazine	0.0001
Benzo[a]pyrene	0.00002
Carbofuran	0.0009
Chlordane	0.0002
Dalapon	0.001

Contaminant	Detection Limit (mg/L)
1,2-Dibromo-3-chloropropane (DBCP)	0.00002
Di(2-ethylhexyl)adipate	0.0006
Di(2-ethylhexyl)phthalate	0.0006
Dinoseb	0.0002
Diquat	0.0004
2,4-D	0.0001
Endothall	0.009
Endrin	0.00001
Ethylene dibromide (EDB)	0.00001
Glyphosate	0.006
Heptachlor	0.00004
Heptachlor epoxide	0.00002
Hexachlorobenzene	0.0001
Hexachlorocyclopentadiene	0.0001
Lindane	0.00002
Methoxychlor	0.0001
Oxamyl	0.002
Picloram	0.0001
Polychlorinated biphenyls (PCBs) (as decachlorobiphenyl)	0.0001
Pentachlorophenol	0.00004
Simazine	0.00007
Toxaphene	0.001
2,3,7,8-TCDD (Dioxin)	0.000000005
2,4,5-TP (Silvex)	0.0002

18. Laboratory Certification: Analysis under 179 NAC 3-006 must only be conducted by the Public Health Environmental Laboratory or other laboratories approved by the Director and certified by EPA or the Director. To receive certification to conduct analyses for the contaminants in 179 NAC 2-002.04B2 the laboratory must:

    a. Analyze Performance Evaluation samples which include those substances provided by EPA Environmental Monitoring and Support Laboratory or equivalent samples provided by the Director at least once a year by each method for which the laboratory desires certification.

    b. For each contaminant that has been included in the PE sample achieve quantitative results on the analyses that are within the following acceptance limits:

Contaminant	Acceptance Limits (%)
Alachlor	± 45.
Aldicarb	2 standard deviations
Aldicarb sulfoxide	2 standard deviations
Aldicarb sulfone	2 standard deviations
Atrazine	± 45.

Contaminant	Acceptance Limits (%)
Benzo[a]pyrene	2 standard deviations
Carbofuran	± 45.
Chlordane	± 45.
Dalapon	2 standard deviations
DBCP	± 40.
Di(2-ethylhexyl)adipate	2 standard deviations
Di(2-ethylhexyl)phthalate	2 standard deviations
Dinoseb	2 standard deviations
Diquat	2 standard deviations
EDB	± 40.
Endothall	2 standard deviations
Endrin	± 30.
Glyphosate	2 standard deviations
Heptachlor	± 45.
Heptachlor epoxide	± 45.
Hexachlorobenzene	2 standard deviations
Hexachlorocyclopentadiene	2 standard deviations
Lindane	± 45.
Methoxychlor	± 45.
Oxamyl	2 standard deviations
PCBs (as decachlorobiphenyl)	0-200.
Pentachlorophenol	± 50.
Picloram	2 standard deviations
Simazine	2 standard deviations
Toxaphene	± 45.
2,3,7,8-TCDD (Dioxin)	2 standard deviations
2,4-D	± 50.
2,4,5-TP (Silvex)	± 50.

19. All new systems or systems that use a new source of water that begin operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the Director. The system must also comply with the initial sampling frequencies specified by the Director to ensure a system can demonstrate compliance with the MCL. Routine and increased monitoring frequencies must be conducted in accordance with the requirements in 179 NAC 3-007.

3-008 RADIOACTIVE CONTAMINANTS

3-008.01 Analysis

3-008.01A Analysis for the following contaminants must be conducted to determine compliance with 179 NAC 2-002.04D (radioactivity) in accordance with the methods in the following table or their equivalent determined in accordance with 179 NAC 3-011 or their equivalent as determined by EPA.

Contaminant	**Methodology**	**References Method or page number**		
		EPA[1]	**EPA[2]**	**SM[3]**
Naturally occurring: Gross alpha[4] and beta	Evaporation	900.0	00-01	7110 B, 7110 B-00
Gross alpha[4]	Co-precipitation		00-02	7110 C, 7110 C-00
Radium 226	Radon emanation	903.1	RA-04	7500-RaC, 7500 Ra C-01
	Radiochemical	903.0	RA-03	7500-RaB, 7500 Ra B-01
Radium 228	Radiochemical	904.0	RA-05	7500-RaD, 7500 Ra D-01
Uranium[5]	Radiochemical	908.0		7500-U B, 7500 U B-00
	Fluorometric	908.1		
	Alpha Spectrometry		00-07	7500-U C (18th, 19th, or 20th ed.), 7500 U C-00
	ICP-MS	200.8		
Man-made: Radioactive cesium	Radiochemical	901.0		7500-Cs B, 7500 Cs B-00
	Gamma ray spectrometry	901.1		7120, 7120-97
Radioactive iodine	Radiochemical	902.0		7500-I B, 7500-I B-00 7500-I C, 7500 –I C-00 7500-I D, 7500-I D-00
	Gamma ray spectrometry	901.1		7120, 7120-97
Radioactive Strontium 89, 90	Radiochemical	905.0	Sr-04	7500-Sr B, 7500 Sr B-01
Tritium	Liquid scintillation	906.0	H-02	7500-^{3}H B, 7500-^{3}H B
Gamma Emitters	Gamma Ray	901.1		7120, 7120-97
	Spectrometry	902.0 901.0		7500-Cs B, 7500-Cs B-00 7500-I B, 7500-I B-00

Footnotes:

The procedures must be done in accordance with the documents listed below which are incorporated herein by reference. Copies of the documents may be obtained from the sources listed below. Documents may be inspected at the Division of Public Health of the Department of Health and Human Services, Nebraska State Office Building, 301 Centennial Mall South, Lincoln, NE 68509.

Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at 800-426-4791.

[1] "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA 600/4-80-032, August 1980. Available at U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (Telephone 800-553-6847) PB 80-224744.

[2] "Radiochemistry Procedures Manual," EPA 520/5-84-006, December 1987. Available at NTIS, ibid. PB 84-215581.

[3] "Standard Methods for the Examination of Water and Wastewater," 18th, 19th, or 20th Editions, 1992, 1995, 1998. Available at American Public Health Association, 1015 Fifteenth Street N.W., Washington, D.C. 20005. Methods 7110B, 7500-Ra B, 7500-Ra C, 7500-Ra D, 7500-U B, 7500-Cs B, 7500-I B, 7500-I C, 7500-I D, 7500-Sr B, 7500-^{3}H B are in the 17th, 18th, 19th and 20th editions. Method 7110 C is in the 18th, 19th and 20th editions. Method 7500-U C Alpha spectrometry is only in the 18th, 19th and 20th editions. Method 7120 is only in the 19th and 20th editions. Method 3125 is only in the 20th edition. Methods 7110 B-00, 7110 C-00, 7500-Ra B-01, 7500-Ra C-01, 7500-Ra D-01, 7500-U C-00, 7500-I B-00, 7500-I C-00, 7500-I D-00, 7120-97, 7500-Sr B-01, and 7500-^{3}H B-00 are available online at http://www.standardmethods.org. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only online versions that may be used.

[4] Natural uranium and thorium-230 are approved as gross alpha calibration standards for gross alpha with co-precipitation and evaporation methods; americium-241 is approved with co-precipitation methods.

[5] If uranium (U) is determined by mass, a 0.67 pCi/µg of uranium conversion factor must be used. This conversion factor is based on the 1:1 activity ratio of U-234 to U-238 that is characteristic of naturally occurring uranium.

3-008.01B For the purpose of monitoring radioactivity concentrations in drinking water, the required sensitivity of the radioanalysis is defined in terms of a detection limit. The detection limit is that concentration which can be counted with a precision of plus or minus 100% at the 95% confidence level (1.96σ where σ is the standard deviation of the net counting rate of the sample).

3-008.01B1 To determine compliance with 179 NAC 2-002.04D1, 2-002.04D2, and 2-002.04D4, the detection limit must not exceed the concentrations listed in the following table:

DETECTION LIMITS FOR GROSS ALPHA PARTICLE ACTIVITY, RADIUM-226, RADIUM-228, AND URANIUM

Contaminant	Detection Limit
Gross alpha particle activity	3 pCi/L
Radium 226	1 pCi/L
Radium 228	1 pCi/L
Uranium	1 µg/L

3-008.01B2 To determine compliance with 179 NAC 2-002.04D3 the detection limits must not exceed the concentrations listed in the following table.

DETECTION LIMITS FOR MAN-MADE BETA PARTICLE AND PHOTON EMMITTERS

Radionuclide	Detection Limit
Tritium	1,000 pCi/L
Strontium-89	10 pCi/L

Strontium-90	2 pCi/L
Iodine-131	1 pCi/L
Cesium-134	10 pCi/L
Gross beta	4 pCi/L
Other radionuclides	1/10 of the applicable limit

3-008.01C To judge compliance with the maximum contaminant levels listed in 179 NAC 2-002.04, averages of data will be used and will be rounded to the same number of significant figures as the maximum contaminant level for the substance in question.

3-008.02 Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems

3-008.02A Monitoring and Compliance Requirements for Gross Alpha Particle Activity, Radium-226, Radium-228, and Uranium

3-008.02A1 Community water systems (CWSs) must conduct initial monitoring to determine compliance with 179 NAC 2-002.04D1, 2-002.04D2, and 2-002.04D4 by December 31, 2007. For the purposes of monitoring for gross alpha particle activity, radium-226, radium-228, uranium, and beta particles and photon radioactivity in drinking water, "detection limit" is defined as in 179 NAC 3-008.01B.

3-008.02A1a Applicability and Sampling Location for Existing Community Water Systems or Sources: All existing CWSs using ground water, surface water, or systems using both ground and surface water (for the purpose of 179 NAC 3-008.02 hereafter referred to as systems) must sample at every entry point to the distribution system that is representative of all sources being used (hereafter called a sampling point) under normal operating conditions. The system must take each sample at the same sampling point unless conditions make another sampling point more representative of each source or the Director has designated a distribution system location, in accordance with 179 NAC 3-008.02A2 item 2.c.

3-008.02A1b Applicability and Sampling Location for New Community Water Systems or Sources: All new CWSs or CWSs that use a new source of water must begin to conduct initial monitoring for the new source within the first quarter after initiating use of the source. CWSs must conduct more frequent monitoring when ordered by the Director in the event of possible contamination or when changes in the distribution system or treatment processes occur which may increase the concentration of radioactivity in finished water.

3-008.02A2 Initial Monitoring: Systems must conduct initial monitoring for gross alpha particle activity, radium-226, radium-228, and uranium as follows:

1. Systems without acceptable historical data, as defined below, must collect four consecutive quarterly samples at all sampling points before December 31, 2007.

2. Grandfathering of Data: The Director may allow historical monitoring data collected at a sampling point to satisfy the initial monitoring requirements for that sampling point, for the following situations:

   a. To satisfy initial monitoring requirements, a community water system having only one entry point to the distribution system may use the monitoring data from the last compliance monitoring period that began between June 2000 and December 8, 2003.

   b. To satisfy initial monitoring requirements, a community water system with multiple entry points and having appropriate historical monitoring data for each entry point to the distribution system may use the monitoring data from the last compliance monitoring period that began between June 2000 and December 8, 2003.

   c. To satisfy initial monitoring requirements, a community water system with appropriate historical data for a representative point in the distribution system may use the monitoring data from the last compliance monitoring period that began between June 2000 and December 8, 2003, provided that the Director finds that the historical data satisfactorily demonstrate that each entry point to the distribution system is expected to be in compliance based upon the historical data and reasonable assumptions about the variability of contaminant levels between entry points. The Director must make a written finding indicating how the data conforms to these requirements.

   3. For gross alpha particle activity, uranium, radium-226, and radium-228 monitoring, the Director may waive the final two quarters of initial monitoring for a sampling point if the results of the samples from the previous two quarters are below the detection limit.

   4. If the average of the initial monitoring results for a sampling point is above the MCL, the system must collect and analyze quarterly samples at that sampling point until the system has results from four consecutive quarters that are at or below the MCL, unless the system enters into another schedule as part of a formal compliance agreement with the Director.

3-008.02A3 Reduced Monitoring: The Director may allow community water systems to reduce the future frequency of monitoring from once every three years to one every six or nine years at each sampling point, based on the following criteria:

1. If the average of the initial monitoring results for each contaminant (i.e., gross alpha particle activity, uranium, radium-226 or radium-228) is

below the detection limit specified in the table in 179 NAC 3-008.01B1, the system must collect and analyze for that contaminant using at least one sample at that sampling point every nine years.

2. For gross alpha particle activity and uranium, if the average of the initial monitoring results for each contaminant is at or above the detection limit but at or below ½ the MCL, the system must collect and analyze for that contaminant using at least one sample at that sampling point every six years. For combined radium-226 and radium-228, the analytical results must be combined. If the average of the combined initial monitoring results for radium-226 and radium-228 is at or above the detection limit but at or below ½ the MCL, the system must collect and analyze for that contaminant using at least one sample at that sampling point every six years.

3. For gross alpha particle activity and uranium, if the average of the initial monitoring results for each contaminant is above ½ the MCL but at or below the MCL, the system must collect and analyze at least one sample at that sampling point every three years. For combined radium-226 and radium-228 the analytical results must be combined. If the average of the combined initial monitoring results for radium-226 and radium-228 is above ½ the MCL but at or below the MCL, the system must collect and analyze at least one sample at that sampling point every three years.

4. Systems must use the samples collected during the reduced monitoring period to determine the monitoring frequency for subsequent monitoring periods (e.g., if a system's sampling point is on a nine year monitoring period, and the sample result is above ½ the MCL, then the next monitoring period for the sampling point is three years).

5. If a system has a monitoring result that exceeds the MCL while on reduced monitoring, the system must collect and analyze quarterly samples at that sampling point until the system has results from four consecutive quarters that are below the MCL, unless the system enters into another schedule as part of a formal compliance agreement with the Director.

3-008.02A4 Compositing: To fulfill quarterly monitoring requirements for gross alpha particle activity, radium-226, radium-228, or uranium, a system may composite up to four consecutive quarterly samples from a single entry point if analysis ~~if~~ is done within a year of the first sample. The Director will treat analytical results from the composited sample as the average analytical result to determine compliance with the MCLs and the future monitoring frequency. If the analytical result from the composited sample is greater than ½ the MCL, the Director may direct the system to take additional quarterly samples before allowing the system to sample under a reduced monitoring schedule.

3-008.02A5 A gross alpha particle activity measurement may be substituted for the required radium-226 measurement provided that the measured gross alpha particle

activity does not exceed 5 pCi/L. A gross alpha particle activity measurement may be substituted for the required uranium measurement provided that the measured gross alpha particle activity does not exceed 15 pCi/L.

The gross alpha measurement must have a confidence interval of 95% (1.65σ, where σ is the standard deviation of the net counting rate of the sample) for radium-226 and uranium. When a system uses a gross alpha particle activity measurement in lieu of a radium-226 and/or uranium measurement, the gross alpha particle activity analytical result will be used to determine the future monitoring frequency for radium-226 and/or uranium. If the gross alpha particle activity result is less than detection, ½ the detection limit will be used to determine compliance and the future monitoring frequency.

3-008.02B Monitoring and Compliance Requirements for Beta Particle and Photon Radioactivity: To determine compliance with the maximum contaminant levels in 179 NAC 2-002.04D3 for beta particle and photon radioactivity, a system must monitor at a frequency as follows:

1. Community Water Systems (Both Surface and Ground Water) Designated by the Director as Vulnerable Must Sample for Beta Particle and Photon Radioactivity: Systems must collect quarterly samples for beta emitters and annual samples for tritium and strontium-90 at each entry point to the distribution system (hereafter called a sampling point) beginning within one quarter after being notified by the Director. Systems already designated by the Director must continue to sample until the Director reviews and either reaffirms or removes the designation.

    a. If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity at a sampling point has a running annual average (computed quarterly) less than or equal to 50 pCi/L (screening level), the Director may reduce the frequency of monitoring at that sampling point to once every 3 years. Systems must collect all samples required in 179 NAC 3-008.02B item 1 during the reduced monitoring period.

    b. For systems in the vicinity of a nuclear facility, the Director may allow the CWS to utilize environmental surveillance data collected by the nuclear facility in lieu of monitoring at the system's entry point(s), where the Director determines if such data is applicable to a particular water system. In the event that there is a release from a nuclear facility, systems which are using surveillance data must begin monitoring at the community water system's entry point(s) in accordance with 179 NAC 3-008.02B item 1.

2. Community water systems (both surface and ground water) designated by the Director as utilizing waters contaminated by effluents from nuclear facilities must sample for beta particle and photon radioactivity. Systems must collect quarterly samples for beta emitters and iodine-131 and annual samples for tritium and strontium-90 at each entry point to the distribution system (hereafter called a sampling point), beginning with one quarter after being notified by the Director. Systems already designated by the Director as

systems using waters contaminated by effluents from nuclear facilities must continue to sample until the Director reviews and either reaffirms or removes the designation.

a. Quarterly monitoring for gross beta particle activity will be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former is recommended.

b. For iodine-131, a composite of five consecutive daily samples must be analyzed once each quarter. As ordered by the Director, more frequent monitoring will be conducted when iodine-131 is identified in the finished water.

c. Annual monitoring for strontium-90 and tritium must be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure is recommended.

d. If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity at a sampling point has a running annual average (computed quarterly) less than or equal to 15 pCi/L (screening level), the Director may reduce the frequency of monitoring at that sampling point to every three years. Systems must collect the same type of samples required in 179 NAC 3-008.02B item 2 during the reduced monitoring period.

e. For systems in the vicinity of a nuclear facility, the Director may allow the CWS to utilize environmental surveillance data collected by the nuclear facility in lieu of monitoring at the system's entry point(s), where the Director determines if such data is applicable to a particular water system. In the event that there is a release from a nuclear facility, systems which are using surveillance data must begin monitoring at the community water system's entry point(s) in accordance with 179 NAC 3-008.02B item 2.

3. Community water systems designated by the Director to monitor for beta particle and photon radioactivity cannot apply to the Director for a waiver from the monitoring frequencies specified in 179 NAC 3-008.02B item 1 or 2.

4. Community water systems may analyze for naturally occurring potassium-40 beta particle activity from the same or equivalent sample used for the gross beta particle activity analysis. Systems are allowed to subtract the potassium-40 beta particle activity value from the total gross beta particle activity value to determine if the screening level is exceeded. The potassium-40 beta particle activity must be calculated by multiplying elemental potassium concentrations (in mg/L) by a factor of 0.82.

5. If the gross beta particle activity minus the naturally occurring potassium-40 beta particle activity exceeds the appropriate screening level, an analysis of the sample must be performed to identify the major radioactive constituents present in the sample and the appropriate doses must be calculated and

summed to determine compliance with 179 NAC 2-002.04D3 item 1 using the formula in 179 NAC 2-002.04D3 item 2. Doses must also be calculated and combined for measured levels of tritium and strontium to determine compliance.

6. Systems must monitor monthly at the sampling point(s) which exceed the maximum contaminant level in 179 NAC 3-008.02D3 beginning the month after the exceedance occurs. Systems must continue monthly monitoring until the system has established, by a rolling average of three monthly samples, that the MCL is being met. Systems that establish that the MCL is being met must return to quarterly monitoring until they meet the requirements set forth in 179 NAC 3-008.02B item 1.a. or 2.d.

3-008.02C General Monitoring and Compliance Requirements for Radionuclides

3-008.02C1 The Director may require more frequent monitoring than specified in 179 NAC 3-008.02A and 3-008.02B or may require confirmation samples at his/her discretion. The results of the initial and confirmation samples will be averaged for use in compliance determinations.

3-008.02C2 Each public water system must monitor at the time designated by the Director during each compliance period.

3-008.02C3 Compliance with 179 NAC 2-002.04D1 through 2-002.04D4 will be determined based on the analytical result(s) obtained at each sampling point. If one sampling point is in violation of an MCL, the system is in violation of the MCL.

3-008.02C3a For systems monitoring more than once per year, compliance with the MCL is determined by a running annual average at each sampling point. If the average of any sampling point is greater than the MCL, then the system is out of compliance with the MCL.

3-008.02C3b For systems monitoring more than once per year, if any sample result will cause the running average to exceed the MCL at any sample point, the system is out of compliance with the MCL immediately.

3-008.02C3c Systems must include all samples taken and analyzed under the provisions of 179 NAC 3-008.02 in determining compliance, even if that number is greater than the minimum required.

3-008.02C3d If a system does not collect all required samples when compliance is based on a running annual average of quarterly samples, compliance will be based on the running average of the samples collected.

3-008.02C3e If a sample result is less than the detection limit, zero will be used to calculate the annual average, unless a gross alpha particle activity is being used in lieu of radium-226, and/or uranium. If the gross alpha particle activity result is less than detection, ½ the detection limit will be used to calculate the annual average.

3-008.02C4 The Director has the discretion to delete results of obvious sampling or analytic errors.

3-008.02C5 If the MCL for radioactivity set forth in 179 NAC 2-002.D1 through 2-002.04D4 is exceeded, the owner of a community water system must give notice to the Director pursuant to 179 NAC 5-004 and the public as required by 179 NAC 4.

3-009 APPROVED LABORATORIES: The Department may enter into an agreement with any laboratory in accordance with the requirements of 179 NAC 20.

3-010 CONSECUTIVE SYSTEMS: When a public water system provides water to one or more other public water systems, the Director may modify the monitoring imposed by 179 NAC 3 to the extent that the inter-connection of the systems justifies treating them as one system for monitoring purposes.

3-011 ALTERNATE ANALYTICAL TECHNIQUES

3-011.01 With the written permission of the Director, concurred in by the Administrator of the U.S. EPA, an alternate analytical technique may be employed. An alternate technique is acceptable only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any MCL. In addition to the methods listed in this chapter, methods found in Alternative Testing Methods Approved for Analyses Under the Safe Drinking Water Act, Appendix A to Subpart C of 40 CFR Part 141, 2013, ~~Attachment 4 which is incorporated herein by reference~~which is available for viewing at the Division of Public Health of the Department of Health and Human Services, 301 Centennial Mall South, Lincoln, NE, or from the U.S. Government Printing Office at http://www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR, may be used as specified. The use of the alternate analytical technique will not decrease the frequency of monitoring required by 179 NAC 3.

3-012 CERTIFIED LABORATORIES

3-012.01 For the purpose of determining compliance with 179 NAC 3, 179 NAC 8, 179 NAC 12, 179 NAC 13, and 179 NAC 16, samples may be considered only if they have been analyzed by the Public Health Environmental Laboratory or a laboratory certified by the Department, except that measurements for alkalinity, calcium, conductivity, disinfectant residual, orthophosphate, pH, silica, temperature and turbidity may be performed by any Grade I, Grade II, Grade III, or Grade IV licensed water operator or an individual who has been trained to take these samples. If a licensed operator does not take the sample, Attachment ~~3~~ 2 to 179 NAC 3, which is incorporated herein by reference, must be completed and sent to the Department.

3-012.02 The Director may take samples and use the results from such samples to determine compliance by a supplier of water with the applicable requirements of 179 NAC 3.

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[1] Native/labeled.
[2] Analysis of this pollutant is approved only for the Centralized Waste Treatment industry.
[3] Analysis of this pollutant is approved only for the Centralized Waste Treatment and Landfills industries.

TABLE 6—ACID EXTRACTABLE COMPOUND CHARACTERISTIC M/Z'S

Compound	Labeled Analog	Primary m/z [1]
p-cresol [2]	d_7	108/116

m/z = mass to charge ratio.
[1] Native/labeled.
[2] Analysis of this pollutant is approved only for the Centralized Waste Treatment and Landfills industries.

TABLE 7—ACCEPTANCE CRITERIA FOR PERFORMANCE TESTS

EGD No.	Compound	Acceptance criteria			Calibration verification sec. 12.5 µg/mL)	On-going accuracy sec. 12.7 R (µg/L)
		Initial precision and accuracy section 8.2 (µg/L)		Labeled compound recovery sec. 8.3 and 14.2 P (percent)		
		s (µg/L)	X			
758	acetophenone [1]	34	44–167		85–115	45–162
658	acetophenone-d_5 [1]	51	23–254	45–162	85–115	22–264
757	aniline [2]	32	30–171		85–115	33–154
657	aniline-d_7 [2]	71	15–278	33–154	85–115	12–344
771	o-cresol [1]	40	31–226		85–115	35–196
671	o-cresol-d_7 [1]	23	30–146	35–196	85–115	31–142
1744	p-cresol [2]	59	54–140		85–115	37–203
1644	p-cresol-d_7 [2]	22	11–618	37–203	85–115	16–415
578	2,3-dichloroaniline [1]	13	40–160		85–115	44–144
1330	pyridine [2]	28	10–421		83–117	18–238
1230	pyridine-d_5 [2]	ns	7–392	19–238	85–115	4–621

s = Standard deviation of four recovery measurements.
X = Average recovery for four recovery measurements.
EGD = Effluent Guidelines Division.
ns = no specification; limit is outside the range that can be measured reliably.
[1] Analysis of this pollutant is approved only for the Centralized Waste Treatment industry.
[2] Analysis of this pollutant is approved only for the Centralized Waste Treatment and Landfills industries.

[49 FR 43261, Oct. 26, 1984; 50 FR 692, 695, Jan. 4, 1985, as amended at 51 FR 23702, June 30, 1986; 62 FR 48405, Sept. 15, 1997; 65 FR 3044, Jan. 19, 2000; 65 FR 81295, 81298, Dec. 22, 2000]

APPENDIX B TO PART 136—DEFINITION AND PROCEDURE FOR THE DETERMINATION OF THE METHOD DETECTION LIMIT—REVISION 1.11

Definition

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Scope and Application

This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete, specific, and well defined analytical method. It is essential that all sample processing steps of the analytical method be included in the determination of the method detection limit.

The MDL obtained by this procedure is used to judge the significance of a single measurement of a future sample.

The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device- or instrument-independent.

Procedure

1. Make an estimate of the detection limit using one of the following:

(a) The concentration value that corresponds to an instrument signal/noise in the range of 2.5 to 5.

(b) The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

(c) That region of the standard curve where there is a significant change in sensitivity, *i.e.*, a break in the slope of the standard curve.

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(d) Instrumental limitations.

It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the initial estimate of the detection limit.

2. Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interferent concentrations are not detected at the method detection limit of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferent). The interferent concentration is presupposed to be normally distributed in representative samples of a given matrix.

3. (a) If the MDL is to be determined in reagent (blank) water, prepare a laboratory standard (analyte in reagent water) at a concentration which is at least equal to or in the same concentration range as the estimated method detection limit. (Recommend between 1 and 5 times the estimated method detection limit.) Proceed to Step 4.

(b) If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated detection limit, proceed to Step 4.

If the measured level of analyte is less than the estimated detection limit, add a known amount of analyte to bring the level of analyte between one and five times the estimated detection limit.

If the measured level of analyte is greater than five times the estimated detection limit, there are two options.

(1) Obtain another sample with a lower level of analyte in the same matrix if possible.

(2) The sample may be used as is for determining the method detection limit if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes as the analyte concentration increases from the MDL, hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

4. (a) Take a minimum of seven aliquots of the sample to be used to calculate the method detection limit and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

(b) It may be economically and technically desirable to evaluate the estimated method detection limit before proceeding with 4a. This will: (1) Prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an inflated MDL will be calculated from data obtained at many times the real MDL even though the level of analyte is less than five times the calculated method detection limit. To insure that the estimate of the method detection limit is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower method detection limit. Take two aliquots of the sample to be used to calculate the method detection limit and process each through the entire method, including blank measurements as described above in 4a. Evaluate these data:

(1) If these measurements indicate the sample is in desirable range for determination of the MDL, take five additional aliquots and proceed. Use all seven measurements for calculation of the MDL.

(2) If these measurements indicate the sample is not in correct range, reestimate the MDL, obtain new sample as in 3 and repeat either 4a or 4b.

5. Calculate the variance (S^2) and standard deviation (S) of the replicate measurements, as follows:

$$S^2 = \frac{1}{n-1}\left[\frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} X_i\right)^2}{n}\right]$$

$$S = \left(S^2\right)^{\frac{1}{2}}$$

where:

X_i; i=1 to n, are the analytical results in the final method reporting units obtained from

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the n sample aliquots and Σ refers to the sum of the X values from i=1 to n.

6. (a) Compute the MDL as follows:

$$MDL = T_{(n-1,1-\alpha=0.99)} \quad (S)$$

where:

MDL = the method detection limit

$t_{(n-1,1-\alpha=.99)}$ = the students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom. See Table.

S = standard deviation of the replicate analyses.

(b) The 95% confidence interval estimates for the MDL derived in 6a are computed according to the following equations derived from percentiles of the chi square over degrees of freedom distribution (χ^2/df).

LCL = 0.64 MDL

UCL = 2.20 MDL

where: LCL and UCL are the lower and upper 95% confidence limits respectively based on seven aliquots.

7. Optional iterative procedure to verify the reasonableness of the estimate of the MDL and subsequent MDL determinations.

(a) If this is the initial attempt to compute MDL based on the estimate of MDL formulated in Step 1, take the MDL as calculated in Step 6, spike the matrix at this calculated MDL and proceed through the procedure starting with Step 4.

(b) If this is the second or later iteration of the MDL calculation, use S^2 from the current MDL calculation and S^2 from the previous MDL calculation to compute the F-ratio. The F-ratio is calculated by substituting the larger S^2 into the numerator S^2_A and the other into the denominator S^2_B. The computed F-ratio is then compared with the F-ratio found in the table which is 3.05 as follows: if $S^2_A/S^2_B<3.05$, then compute the pooled standard deviation by the following equation:

$$S_{pooled} = \left[\frac{6S_A^2 + 6S_B^2}{12}\right]^{\frac{1}{2}}$$

if $S^2_A/S^2_B>3.05$, respike at the most recent calculated MDL and process the samples through the procedure starting with Step 4. If the most recent calculated MDL does not permit qualitative identification when samples are spiked at that level, report the MDL as a concentration between the current and previous MDL which permits qualitative identification.

(c) Use the S_{pooled} as calculated in 7b to compute The final MDL according to the following equation:

$MDL=2.681\ (S_{pooled})$

where 2.681 is equal to $t_{(12,1-\alpha=.99)}$.

(d) The 95% confidence limits for MDL derived in 7c are computed according to the following equations derived from precentiles of the chi squared over degrees of freedom distribution.

LCL=0.72 MDL

UCL=1.65 MDL

where LCL and UCL are the lower and upper 95% confidence limits respectively based on 14 aliquots.

TABLES OF STUDENTS' T VALUES AT THE 99 PERCENT CONFIDENCE LEVEL

Number of replicates	Degrees of freedom (n-1)	$t_{(n-1,.99)}$
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
61	60	2.390
00	00	2.326

TABLES OF STUDENTS' T VALUES AT THE 99 PERCENT CONFIDENCE LEVEL—Continued

Reporting

The analytical method used must be specifically identified by number or title ald the MDL for each analyte expressed in the appropriate method reporting units. If the analytical method permits options which affect the method detection limit, these conditions must be specified with the MDL value. The sample matrix used to determine the MDL must also be identified with MDL value. Report the mean analyte level with the MDL and indicate if the MDL procedure was iterated. If a laboratory standard or a sample that contained a known amount analyte was used for this determination, also report the mean recovery.

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If the level of analyte in the sample was below the determined MDL or exceeds 10 times the MDL of the analyte in reagent water, do not report a value for the MDL.

[49 FR 43430, Oct. 26, 1984; 50 FR 694, 696, Jan. 4, 1985, as amended at 51 FR 23703, June 30, 1986]

APPENDIX C TO PART 136—INDUCTIVELY COUPLED PLASMA—ATOMIC EMISSION SPECTROMETRIC METHOD FOR TRACE ELEMENT ANALYSIS OF WATER AND WASTES METHOD 200.7

1. Scope and Application

1.1 This method may be used for the determination of dissolved, suspended, or total elements in drinking water, surface water, and domestic and industrial wastewaters.

1.2 Dissolved elements are determined in filtered and acidified samples. Appropriate steps must be taken in all analyses to ensure that potential interferences are taken into account. This is especially true when dissolved solids exceed 1500 mg/L. (See Section 5.)

1.3 Total elements are determined after appropriate digestion procedures are performed. Since digestion techniques increase the dissolved solids content of the samples, appropriate steps must be taken to correct for potential interference effects. (See Section 5.)

1.4 Table 1 lists elements for which this method applies along with recommended wavelengths and typical estimated instrumental detection limits using conventional pneumatic nebulization. Actual working detection limits are sample dependent and as the sample matrix varies, these concentrations may also vary. In time, other elements may be added as more information becomes available and as required.

1.5 Because of the differences between various makes and models of satisfactory instruments, no detailed instrumental operating instructions can be provided. Instead, the analyst is referred to the instruction provided by the manufacturer of the particular instrument.

2. Summary of Method

2.1 The method describes a technique for the simultaneous or sequential multielement determination of trace elements in solution. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique. Samples are nebulized and the aerosol that is produced is transported to the plasma torch where excitation occurs. Characteristic atomic-line emission spectra are produced by a radio-frequency inductively coupled plasma (ICP). The spectra are dispersed by a grating spectrometer and the intensities of the lines are monitored by photomultiplier tubes. The photocurrents from the photomultiplier tubes are processed and controlled by a computer system. A background correction technique is required to compensate for variable background contribution to the determination of trace elements. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. The position used must be free of spectral interference and reflect the same change in background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. The possibility of additional interferences named in 5.1 (and tests for their presence as described in 5.2) should also be recognized and appropriate corrections made.

3. Definitions

3.1 *Dissolved*—Those elements which will pass through a 0.45 μm membrane filter.

3.2 *Suspended*—Those elements which are retained by a 0.45 μm membrane filter.

3.3 *Total*—The concentration determined on an unfiltered sample following vigorous digestion (Section 9.3), or the sum of the dissolved plus suspended concentrations. (Section 9.1 plus 9.2).

3.4 *Total recoverable*—The concentration determined on an unfiltered sample following treatment with hot, dilute mineral acid (Section 9.4).

3.5 *Instrumental detection limit*—The concentration equivalent to a signal, due to the analyte, which is equal to three times the standard deviation of a series of ten replicate measurements of a reagent blank signal at the same wavelength.

3.6 *Sensitivity*—The slope of the analytical curve, *i.e.*, functional relationship between emission intensity and concentration.

3.7 *Instrument check standard*—A multielement standard of known concentrations prepared by the analyst to monitor and verify instrument performance on a daily basis. (See 7.6.1)

3.8 *Interference check sample*—A solution containing both interfering and analyte elements of known concentration that can be used to verify background and interelement correction factors. (See 7.6.2.)

3.9 *Quality control sample*—A solution obtained from an outside source having known, concentration values to be used to verify the calibration standards. (See 7.6.3)

3.10 *Calibration standards*—A series of known standard solutions used by the analyst for calibration of the instrument (*i.e.*, preparation of the analytical curve). (See 7.4)

179 NAC 3 Attachment ~~2~~1

METHOD #: 340.1 Approved for NPDES and SDWA (Ed. Rev. 1974, 1978)

TITLE: Fluoride, Total (Colorimetric, SPADNS with Bellack Distillation)

ANALYTE: CAS # F Fluoride 7782-41-4

INSTRUMENTATION: Spectrophotometer

STORET No. Total 00951 Dissolved 00950

1.0 Scope and Application

1.1 This method is applicable to the measurement of fluoride in drinking, surface, and saline waters, domestic and industrial wastes.
1.2 The method covers the range from 0.1 to about 1.4 mg/L F. This range may be extended to 1000 mg/L using the Fluoride Ion Selective Electrode Method (340.2) after distillation.

2.0 Summary of Method

2.1 Following distillation to remove interferences, the sample is treated with the SPADNS reagent. The loss of color resulting from the reaction of fluoride with the zirconyl- SPADNS dye is a function of the fluoride concentration.

3.0 Comments

3.1 The SPADNS reagent is more tolerant of interfering materials than other accepted fluoride reagents. Reference to Table 414:1, p 388, Standard Methods for the Examination of Waters and Wastewaters, 14th Edition, will help the analyst decide if distillation is required. The addition of the highly colored SPADNS reagent must be done with utmost accuracy because the fluoride concentration is measured as a difference of absorbance in the blank and the sample. A small error in reagent addition is the most prominent source of error in this test.
3.2 Care must be taken to avoid overheating the flask above the level of the solution. This is done by maintaining an even flame entirely under the boiling flask.

4.0 Apparatus

4.1 Distillation apparatus: A 1-liter round-bottom, long-necked pyrex boiling flask, connecting tube, efficient condenser, thermometer adapter and thermometer reading to 200°C. All connections should be ground glass. Any apparatus equivalent to that shown in Figure 1 is acceptable.
4.2 Colorimeter: One of the following

4.2.1 Spectrophotometer for use at 570 nm providing a light path of at least 1 cm.

4.2.2 Filter photometer equipped with a greenish yellow filter having maximum transmittance at 550 to 580 nm and a light path of at least 1 cm.

5.0 Reagents

5.1 Sulfuric acid, H_2SO_4, conc.

5.2 Silver sulfate, Ag_2SO_4 crystals.

5.3 Stock fluoride solution: Dissolve 0.221 g anhydrous sodium fluoride, NaF, in distilled water in a l-liter volumetric flask and dilute to the mark with distilled water; 1.00 mL = 0.1 mg F.

5.4 Standard fluoride solution: Place 100 mL stock fluoride solution (5.3) in a 1 liter volumetric flask and dilute to the mark with distilled water; 1.00 mL = 0.010 mg F.

5.5 SPADNS solution: Dissolve 0.958 g SPADNS, sodium 2-(parasulfophenylazo)-1,8- dihydroxy-3,6-naphthalene disulfonate, in distilled water in a 500 mL volumetric flask and dilute to the mark. Stable indefinitely if protected from direct sunlight.

5.6 Zirconyl-acid reagent: Dissolve 0.133 g zirconyl chloride octahydrate, $ZrOCl_2 \cdot 8H_2O$ in approximately 25 mL distilled water in a 500 mL volumetric flask. Add 350 mL conc HCl and dilute to the mark with distilled water.

5.7 Acid-zirconyl-SPADNS reagent: Mix equal volumes of SPADNS solution (5.5) and zirconyl-acid reagent (5.6). The combined reagent is stable for at least 2 years.

5.8 Reference solution: Add 10 mL SPADNS solution (5.5) to 100 mL distilled water. Dilute 7 mL conc HCl to 10 mL and add to the dilute SPADNS solution. This solution is used for zeroing the spectrophotometer or photometer. It is stable and may be used indefinitely.

5.9 Sodium arsenite solution: Dissolve 5.0 g $NaAsO_2$ in distilled water in a 1-liter volumetric flask and dilute to the mark with distilled water (CAUTION: Toxic-avoid ingestion).

6.0 Procedure

6.1 Preliminary distillation

6.1.1 Place 400 mL distilled water in the distilling flask.

6.1.2 Carefully add 200 mL conc. H_2SO_4 and swirl until contents are homogeneous.

6.1.3 Add 25 to 35 glass beads, connect the apparatus (Figure 1 making sure all joints are tight.

6.1.4 Heat slowly at first, then as rapidly as the efficiency of the condenser will permit (distillate must be cool) until the temperature of the flask contents reaches exactly 180°C. Discard the distillate. This process removes fluoride contamination and adjusts the acid-water ratio for subsequent distillations.

6.1.5 Cool to 120°C or below.

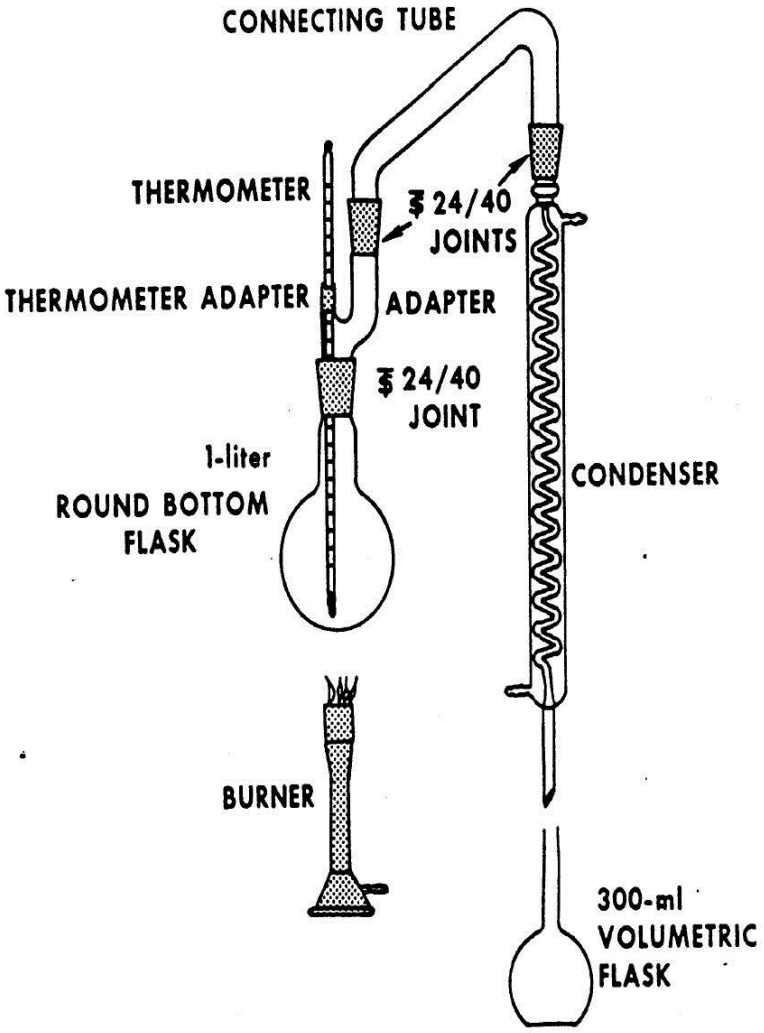

FIGURE 1 DIRECT DISTILLATION APPARATUS FOR FLUORIDE.

6.1.6 Add 300 mL sample, mix thoroughly, distill as in 6.1.4 until temperature reaches 180°C. Do not heat above 180°C to prevent sulfate carryover.

6.1.7 Add Ag_2SO_4 (5.2) at a rate of 5 mg/mg Cl when high chloride samples are distilled.

6.1.8 Use the sulfuric acid solution in the flask repeatedly until the contaminants from the samples accumulate to such an extent that recovery is affected or interferences appear in the distillate. Check periodically by distilling standard fluoride samples.

6.1.9 High fluoride samples may require that the still be flushed by using distilled water and combining distillates.

6.2 Colorimetric Determination

6.2.1 Prepare fluoride standards in the range 0 to 1.40 mg/L by diluting appropriate quantities of standard fluoride solution (5.4) to 50 mL with distilled water.

6.2.2 Pipet 5.00 mL each of SPADNS solution (5.5) and zirconyl-acid reagent (5.6) or 10.00 mL of the mixed acid-zirconyl-SPADNS reagent (5.7) to each standard and mix well.

6.2.3 Set photometer to zero with reference solution (5.8) and immediately obtain absorbance readings of standards.

6.2.4 Plot absorbance versus concentration. Prepare a new standard curve whenever fresh reagent is made.

6.2.5 If residual chlorine is present pretreat the sample with 1 drop (0.05 ml) $NaAsO_2$, solution (5.9) per 0.1 mg residual chlorine mix. Sodium arsenite concentrations of 1300 mg/L produce an of 0.1 mg/L at 1.0 mg/L F.

6.2.6 Use a 50 mL sample or a portion diluted to 50 mL. Adjust the temperature of the sample to that used for the standard curve.

6.2.7 Perform step 6.2.2 and 6.2.3.

7.0 Calculations

7.1 Read the concentration in the 50 mL sample using the standard curve (6.2.4)

7.2 Calculate as follows:

$$\textbf{mg/L F} = \frac{\textbf{mg F x 1,000}}{\textbf{mL sample}}$$

7.3 When a sample (mL sample) is diluted to a volume (B) and then a portion (C) is analyzed, use:

$$\textbf{mg/L F} = \frac{\textbf{mg F x 1,000}}{\textbf{m/L sample}} \times \frac{\textbf{B}}{\textbf{C}}$$

8.0 Precision and Accuracy

8.1 On a sample containing 0.83 mg/L F with no interferences, 53 analysts using the Bellack distillation and the SPADNS reagent obtained a mean of 0.81 mg/L F with a standard deviation of ±0.089 mg/L.

8.2 On a sample containing 0.57 mg/L F (with 200 mg/L SO_4 and 10 mg/L Al as interferences) 53 analysts using the Bellack distillation obtained a mean of 0.60 mg/L F with a standard deviation of ±0.103 mg/L.

8.3 On a sample containing 0.68 mg/L F (with 200 mg/L SO_4, 2 mg/L Al and 2.5 mg/L [$Na(PO_3)_6$] as interferences), 53 analysts using the Bellack distillation obtained a mean of 0.72 mg/L F with a standard deviation of ±0.092 mg/L. (Analytical Reference Service, Sample 11 I-B water, Fluoride, August, 1961.)

Bibliography

1. Standard Methods for the Examination of Water and Wastewater, p. 389-390 (Method No.414A, Preliminary Distillation Step) and p. 393-394 (Method 414C SPADNS) 14th Edition, (1975).
2. Annual Book of ASTM Standards, Part 31, "Water", Standard D 1179-72, Method A, p. 310 (1976).

METHOD #: 340.2 Approved for NPDES and SDWA (Editorial Rev.1974)

TITLE: Fluoride (Potentiometric, Ion Selective Electrode)

ANALYTE: CAS # F Fluoride 7782-41-4

INSTRUMENTATION: ISE

STORET No: Total 00951
Dissolved 00950

1.0 Scope and Application

1.1 This method is applicable to the measurement of fluoride in drinking, surface and saline waters, domestic and industrial wastes.
1.2 Concentration of fluoride from 0.1 up to 1000 mg/liter may be measured.
1.3 For Total or Total Dissolved Fluoride, the Bellack distillation is required for NPDES monitoring but is not required for SDWA monitoring.

2.0 Summary of Method

2.1 The fluoride is determined potentiometrically using a fluoride electrode in conjunction with a standard single junction sleeve-type reference electrode and a pH meter having an, expanded millivolt scale or a selective ion meter having a direct concentration scale for fluoride.
2.2 The fluoride electrode consists of a lanthanum fluoride crystal across which a potential is developed by fluoride ions. The cell may be represented by Ag/Ag Cl, Cl (0.3), F (0.001) LaF/test solution/SCE/. --

3.0 Interferences

3.1 Extremes of pH interfere; sample pH should be between 5 and 9. Polyvalent cations of Si , Fe and Al interfere by forming complexes with fluoride. The $^{+4}$ $^{+3}$ $^{+3}$ degree of interference depends upon the concentration of the complexing cations, the concentration of fluoride and the pH of the sample. The addition of a pH 5.0 buffer (described below) containing a strong chelating agent preferentially complexes aluminum (the most common interference), silicon and iron and eliminates the pH problem.

4.0 Sampling Handling and Preservation

4.1 No special requirements.

5.0 Apparatus

5.1 Electrometer (pH meter), with expanded mv scale, or a selective ion meter such as the Orion 400 Series.
5.2 Fluoride Ion Activity Electrode, such as Orion No. 94-09 . (1)
5.3 Reference electrode, single junction, sleeve-type, such as Orion No. 90-01, Beckman No. 40454, or Corning No. 476010.

5.4 Magnetic Mixer, Teflon-coated stirring bar.

6.0 Reagents

6.1 Buffer solution, pH 5.0-5.5: To approximately 500 mL of distilled water in a 1 liter beaker add 57 mL of glacial acetic acid, 58 g of sodium chloride and 4 g of CDTA . Stir to dissolve and cool to room temperature. Adjust pH of [(2)] solution to between 5.0 and 5.5 with 5 N sodium hydroxide (about 150 mL will be required). Transfer solution to a 1 liter volumetric flask and dilute to the mark with distilled water. For work with brines, additional NaCl should be added to raise the chloride level to twice the highest expected level of chloride in the sample.

6.2 Sodium fluoride, stock solution: 1.0 mL = 0.1 mg F. Dissolve 0.2210 g of sodium fluoride in distilled water and dilute to 1 liter in a volumetric flask. Store in chemical-resistant glass or polyethylene.

6.3 Sodium fluoride, standard solution: 1.0 mL = 0.01 mg F. Dilute 100.0 mLof sodium fluoride stock solution (6.2) to 1000 mL with distilled water.

6.4 Sodium hydroxide, 5N: Dissolve 200 g sodium hydroxide in distilled water, cool and dilute to 1 liter.

7.0 Calibration

7.1 Prepare a series of standards using the fluoride standard solution (6.3) in the range of 0 to 2.00 mg/L by diluting appropriate volumes to 50.0 mL. The following series may be used:

Millimeters of Standard (1.0 mL = 0.01 mg/F)	Concentration when Diluted to 50 ml, mg F/liter
0.00	0.00
1.00	0.20
2.00	0.40
3.00	0.60
4.00	0.80
5.00	1.00
6.00	1.20
8.00	1.60
10.00	2.00

7.2 Calibration of Electrometer: Proceed as described in (8.1). Using semilogarithmic graph paper, plot the concentration of fluoride in mg/liter on the log axis vs. the electrode potential developed in the standard on the linear axis, starting with the lowest concentration at the bottom of the scale. Calibration of a selective ion meter: Follow the directions of the manufacturer for the operation of the instrument.

8.0 Procedure

8.1 Place 50.0 mL of sample or standard solution and 50.0 mL of buffer (See Note) in a 150 mL beaker. Place on a magnetic stirrer and mix at medium speed. Immerse the electrodes in the solution and observe the meter reading while mixing. The electrodes must remain in the solution for at least three minutes or until the reading has stabilized. At concentrations under 0.5 mg/liter F, it may require as long as five minutes to reach a stable meter reading; high concentrations stabilize more quickly. If a pH meter is used, record the potential measurement for each unknown sample and convert the potential reading to the fluoride ion concentration of the unknown using the standard curve. If a selective ion meter is used, read the fluoride level in the unknown sample directly in mg/L on the fluoride scale.

NOTE: For industrial waste samples, this amount of buffer may not be adequate. Analyst should check pH first. If highly basic (> 9), add 1 N HCl to adjust pH to 8.3.

9.0 Precision and Accuracy

9.1 A synthetic sample prepared by the Analytical Reference Service, PHS, containing 0.85 mg/L fluoride and no interferences was analyzed by 111 analysts; a mean of 0.84 mg/L with a standard deviation of ±0.03 was obtained.

9.2 On the same study, a synthetic sample containing 0.75 mg/L fluoride, 2.5 mg/L polyphosphate and 300 mg/L alkalinity, was analyzed by the same 111 analysts; a mean of 0.75 mg/L fluoride with a standard deviation of ±0.036 was obtained.

Bibliography

1. Patent No. 3,431,182 (March 4, 1969).
2. CDTA is the abbreviated designation of 1 ,2-cyclohexylene dinitrilo tetraacetic acid. (The monohydrate form may also be used.) Eastman Kodak 15411, Mallinckrodt 2357, Sigma D 1383, Tridom-Fluka 32869-32870 or equivalent.
3. Standard Methods for the Examination of Water and Wastewaters, p 389, Method No. 414A, Preliminary Distillation Step (Bellack), and p 391, Method No. 414B, Electrode Method, 14th Edition (1975).
4. Annual Book of ASTM Standards, Part 31, "Water", Standard D1179-72, Method B, p 312 (1976).

METHOD #: 340.3 Approved for NPDES (Issued 1971)

TITLE: Fluoride (Colorimetric, Automated Complexone)

ANALYTE: CAS # F Fluoride 7782-41-4

INSTRUMENTATION: Autoanalyzer

STORET No. Total 00951
Dissolved 00950

1.0 Scope and Application

1.1 This method is applicable to drinking, surface and saline waters, domestic and industrial wastes. The applicable range of the method is 0.05 to 1.5 mg F/L. Twelve samples per hour can be analyzed.
1.2 For Total or Total Dissolved Fluoride, the Bellack Distillation must be performed on the samples prior to analysis by the complexone method.

2.0 Summary of Method

2.1 Fluoride ion reacts with the red cerous chelate of alizarin complexone. It is unlike other fluoride procedures in that a positive color is developed as contrasted to a bleaching action in previous methods.

3.0 Sample Handling and Preservation

3.1 No special requirements.

4.0 Interferences

4.1 Method is free from most anionic and cationic interferences, except aluminum, which forms an extremely stable fluoro compound, AlF . This is overcome by treatment with 8-hydroxyquinoline to complex the aluminum and by subsequent extraction with chloroform. At aluminum levels below 0.2 mg/L, the extraction procedure is not required.

5.0 Apparatus

5.1 Technicon AutoAnalyzer Unit consisting of:
5.1.1 Sampler I.
5.1.2 Manifold.
5.1.3 Proportioning pump.
5.1.4 Continuous filter.
5.1.5 Colorimeter equipped with 15 mm tubular flow cell and 650 filters.
5.1.6 Recorder equipped with range expander.

6.0 Reagents

6.1 Sodium acetate solution: Dissolve 272 g (2 moles) of sodium acetate in distilled water and dilute to 1 liter.

6.2 Acetic acid-8-hydroxyquinoline solution: Dissolve 6 g of 8-hydroxyquinoline in 34 mL of conc. acetic acid, and dilute to 1 liter with distilled water.

6.3 Chloroform: Analytical reagent grade.

6.4 Ammonium acetate solution (6.7%): Dissolve 67 g of ammonium acetate in distilled water and dilute to 1 liter.

6.5 Hydrochloric acid (2 N): Dilute 172 mL of conc. HCl to 1 liter

6.6 Lanthanum alizarin fluoride blue solution : Dissolve 0.18 g of alizarin fluoride (1) blue in a solution containing 0.5 mL of conc. ammonium hydroxide and 15 mL of 6.7% ammonium acetate (6.4). Add a solution that contains 41 g of anhydrous sodium carbonate and 70 mL of glacial acetic acid in 300 mL of distilled water. Add 250 mL of acetone. Dissolve 0.2 g of lanthanum oxide in 12.5 mL of 2 N hydrochloric acid (6.5) and mix with above solution. Dilute to 1 liter.

6.7 Stock solution: Dissolve 2.210 g of sodium fluoride in 100 mL of distilled water and dilute to 1 liter in a volumetric flask. 1.0 mL = 1.0 mg F.

6.8 Standard Solution: Dilute 10.0 mL of stock solution to 1 liter in a volumetric flask. 1.0 mL = 0.01 mg F.

6.8.1 Using standard solution, prepare the following standards in 100 mL volumetric flask:

mg F/L	mL Standard Solution/100 mL
0.05	0.5
0.10	1.0
0.20	2.0
0.40	4.0
0.60	6.0
0.80	8.0
1.00	10.0
1.20	12.0
1.50	15.0

7.0 Procedure

7.1 Set up manifold as shown in Figure 1.

7.2 Allow both colorimeter and recorder to warm up for 30 minutes. Run a baseline with all reagents, feeding distilled water through the sample line. Adjust dark current and operative opening on colorimeter to obtain stable baseline.

7.3 Place distilled water wash tubes in alternate openings in Sampler and set sample timing at 2.5 minutes.

7.4 Arrange fluoride standards in Sampler in order of decreasing concentration. Complete loading of Sampler tray with unknown samples.

7.5 Switch sample line from distilled water to Sampler and begin analysis.

8.0 Calculation

8.1 Prepare standard curve by plotting peak heights of processed fluoride standards against concentration values. Compute concentration of samples by comparing sample peak heights with standard curve.

9.0 Precision and Accuracy

9.1 In a single laboratory (EMSL), using surface water samples at concentrations of 0.06, 0.15, and 1.08 mg F/L, the standard deviation was ± 0.018.

9.2 In a single laboratory (EMSL), using surface water samples at concentrations of 0.14 and 1.25 mg F/L, recoveries were 89% and 102%, respectively.

Bibliography

1. J.T. Baker Laboratory Chemical No. J 112 or equivalent.
2. Greenhaigh, R., and Riley, J. P., "The Determination of Fluorides in Natural Waters, with Particular Reference to Sea Water". Anal. Chim. Acta, 25, 179 (1961).
3. Chan, K. M., and Riley, J. P., "The Automatic Determination of Fluoride in Sea Water and Other Natural Water". Anal. Chim. Acta, 35, 365 (1966).
4. Standard Methods for the Examination of Water and Wastewater, 14th Edition, p 614, Method 603, (1975).

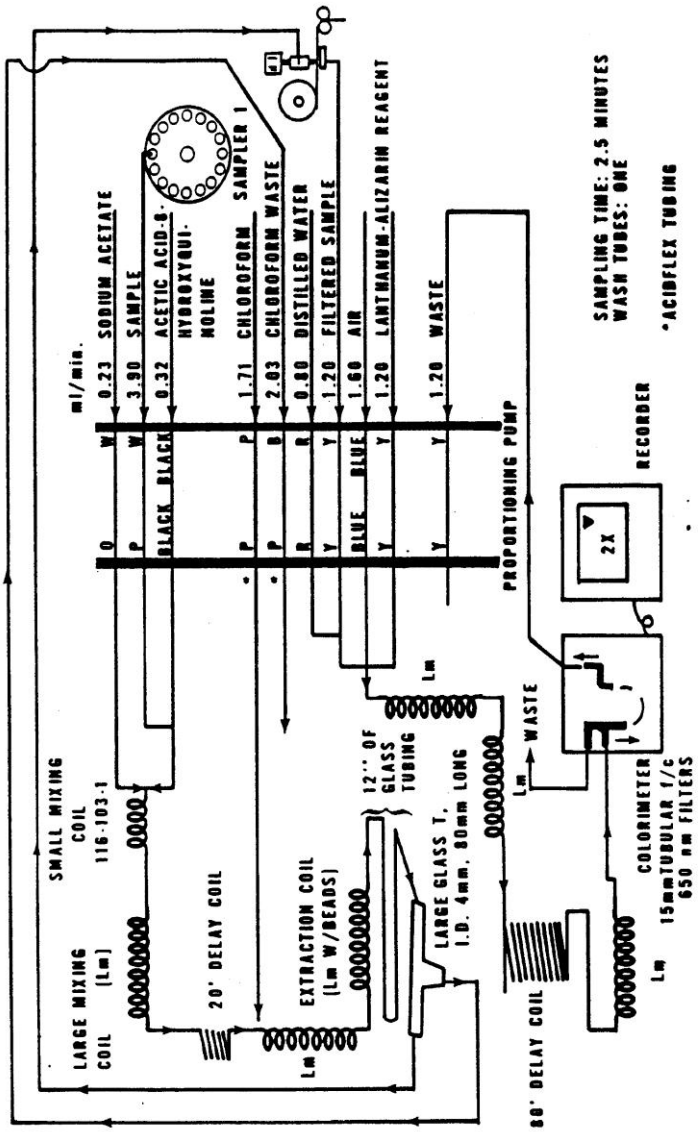

FIGURE 1. FLUORIDE MANIFOLD AA-I

179 NAC 3 ATTACHMENT ~~3~~ 2

Sampling Training For Individuals Other Than Licensed Operators

PWS System or Community Name: _____

Name of individual taking samples: _____

Parameter(s) sampled routinely by the above individual:

_____

Trainer and Title: _____

Training material used: _____

Handouts given to the above individual:

_____

I certify that on _____ I personally provided the necessary sampling
(Date)

training to assure quality data and approve the above individual as qualified to perform the

above sampling tasks.

X _____
(Signature of Trainer) (License Number)

I certify that I did receive said training and I understand how to properly sample the above parameters.

X _____
(Signature of Approved Sampling Individual)

When the above-named trained individual no longer takes the samples the individual has been trained to take, I will inform the Division of Public Health of the Nebraska Department of Health and Human Services, Field Services Program Manager at (402) 471-0521 within seven days. Acknowledged by System Owner or Operator in Charge:

X _____ Date: _____
(Signature)

(Keep a copy for your records and submit original within seven days to DHHS, Public Water Program at P. O. Box 95026, Lincoln, NE 68509-5026)

~~179 NAC 3 ATTACHMENT 4~~DELETE ATTACHMENT 4

Appendix A to Subpart C of Part 141 - Alternative Testing Methods Approved for Analyses Under the Safe Drinking Water Act. Only the editions stated in the following table are approved.

Alternative testing methods for contaminants listed at 40 CFR 141.21(f)(3)			
Organism	Methodology	SM 21st Edition [1]	Other
Total Coliforms	Total Coliform Fermentation Technique	9221 A, B	
	Total Coliform Membrane Filter Technique	9222 A, B, C	
	Presence-Absence (P-A) Coliform Test	9221 D	
	ONPG-MUG Test	9223	
	Colitag™		Modified Colitag™ [13]

Alternative testing methods for contaminants listed at 40 CFR 141.21(f)(6)					
Organism	Methodology	SM 20th Edition [6]	SM 21st Edition [1]	SM Online [3]	Other
E.coli	ONPG-MUG Test	9223 B	9223 B	9223 B-97	
					Modified Colitag™ [13]

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Alkalinity	Titrimetric		2320 B			
Antimony	Hydride – Atomic Absorption				D 3697-07	
	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]				

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Arsenic	Atomic Absorption; Furnace		3113 B		D 2972-08 C	
	Hydride Atomic Absorption		3114 B		D 2972-08 B	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Barium	Inductively Coupled Plasma		3120 B			
	Atomic Absorption; Direct		3111 D			
	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Beryllium	Inductively Coupled Plasma		3120 B			
	Atomic Absorption; Furnace		3113 B		D 3645-08 B	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Cadmium	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Calcium	EDTA titrimetric		3500-Ca B		D 511-09 A	
	Atomic Absorption; Direct Aspiration		3111 B		D 511-09 B	
	Inductively Coupled Plasma		3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Chromium	Inductively Coupled Plasma		3120 B			
	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Copper	Atomic Absorption; Furnace		3113 B		D 1688-07 C	
	Atomic Absorption; Direct Aspiration		3111 B		D 1688-07 A	
	Inductively Coupled Plasma		3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Conductivity	Conductance		2510 B			

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Cyanide	Manual Distillation followed by				D2036-06 A	
	Spectrophotometric, Amenable		4500-CN^- G		D2036-06 B	
	Spectrophotometric Manual		4500-CN^- E		D2036-06 A	
	Selective Electrode		4500-CN^- F			
	Gas Chromatography/Mass Spectrometry Headspace					ME355.01[7]
Fluoride	Ion Chromatography		4110 B			
	Manual Distillation; Colorimetric SPADNS		4500-F^- B, D			
	Manual Electrode		4500-F^- C		D1179-04 B	
	Automated Alizarin		4500-F^- E			
Lead	Atomic Absorption; Furnace		3113 B		D 3559-08 D	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Magnesium	Atomic Absorption		3111 B		D 511-09 B	
	Inductively Coupled Plasma		3120 B			
	Complexation Titrimetric Methods		3500-Mg B		D 511-09 A	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Mercury	Manual, Cold Vapor		3112 B			

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Nickel	Inductively Coupled Plasma		3120 B			
	Atomic Absorption; Direct		3111 B			
	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Nitrate	Ion Chromatography		4110 B			
	Automated Cadmium Reduction		4500-NO_3^- F			
	Manual Cadmium Reduction		4500-NO_3^- E			
	Ion Selective Electrode		4500-NO_3^- D			
	Reduction/Colorimetric					Systea Easy (1-Reagent)[8]
Nitrite	Ion Chromatography		4110 B			
	Automated Cadmium Reduction		4500-NO_3^- F			
	Manual Cadmium Reduction		4500-NO_3^- E			
	Spectrophotometric		4500-NO_2^- B			
	Reduction/Colorimetric					Systea Easy (1-Reagent)[8]

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Orthophosphate	Ion Chromatography		4110 B			
	Colorimetric, ascorbic acid, single reagent		4500-P E	4500-P E-99		
	Colorimetric, Automated, Ascorbic Acid		4500-P F	4500-P F-99		
pH	Electrometric		4500-H^+ B			
Selenium	Hydride-Atomic Absorption		3114 B		D 3859-08 A	
	Atomic Absorption; Furnace		3113 B		D 3859-08 B	
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Silica	Colorimetric				D859-05	
	Molybdosilicate		4500-SiO_2 C			
	Heteropoly blue		4500-SiO_2 D			
	Automated for Molybdate-reactive Silica		4500-SiO_2 E			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
	Inductively Coupled Plasma		3120 B			

Alternative testing methods for contaminants listed at 40 CFR 141.23 (k)(1)						
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM Online [3]	ASTM [4]	Other
Sodium	Atomic Absorption; Direct Aspiration		3111 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2				
Temperature	Thermometric		2550			

Alternative testing methods for contaminants listed at 40 CFR 141.24 (e)(1)				
Contaminant	Methodology	EPA Method	SM 21st Edition[1]	SM Online [3]
Benzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3 [9]		
Carbon tetrachloride	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Chlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,2-Dichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,4-Dichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,2-Dichloroethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
cis-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Trans-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Dichloromethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,2-Dichloropropane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Ethylbenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Styrene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Tetrachloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,1,1-Trichloroethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		

Alternative testing methods for contaminants listed at 40 CFR 141.24 (e)(1)				
Contaminant	Methodology	EPA Method	SM 21st Edition[1]	SM Online[3]
Trichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Toluene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,2,4-Trichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,1-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,1,2-Trichlorethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Vinyl chloride	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Xylenes (total)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Carbofuran	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B-04
Dalapon	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557[14]	6640 B	6640 B-01
Dibromochloropropane (DBCP)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Ethyl dibromide (EDB)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Oxamyl	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B-04
Total Trihalomethanes	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		

Alternative testing methods for contaminants listed at 40 CFR 141.25(a)			
Contaminant	Methodology	SM 21st Edition[1]	ASTM[4]
Naturally Occurring:			
Gross alpha and beta	Evaporation	7110 B	
Gross alpha	Coprecipitation	7110 C	
Radium 226	Radon emanation	7500-Ra C	D3454-05
	Radiochemical	7500-Ra B	D2460-07

Alternative testing methods for contaminants listed at 40 CFR 141.24 (e)(1)				
Contaminant	Methodology	EPA Method	SM 21st Edition[1]	SM Online[3]
Trichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Toluene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,2,4-Trichlorobenzene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,1-Dichloroethylene	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
1,1,2-Trichlorethane	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Vinyl chloride	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Xylenes (total)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Carbofuran	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B-04
Dalapon	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557[14]	6640 B	6640 B-01
Dibromochloropropane (DBCP)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Ethyl dibromide (EDB)	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		
Oxamyl	High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection		6610 B	6610 B-04
Total Trihalomethanes	Purge &Trap/Gas Chromatography/Mass Spectrometry	524.3		

Alternative testing methods for contaminants listed at 40 CFR 141.25(a)			
Contaminant	Methodology	SM 21st Edition[1]	ASTM[4]
Naturally Occurring:			
Gross alpha and beta	Evaporation	7110 B	
Gross alpha	Coprecipitation	7110 C	
Radium 226	Radon emanation	7500-Ra C	D3454-05
	Radiochemical	7500-Ra B	D2460-07

Alternative testing methods for contaminants listed at 40 CFR 141.25(a)			
Contaminant	Methodology	SM 21st Edition [1]	ASTM [4]
Radium 228	Radiochemical	7500-Ra D	
Uranium	Radiochemical	7500-U B	
	ICP-MS		D5673-05
	Alpha spectrometry	7500-U C	
	Laser Phosphorimetry		D5174-07
Man-Made:			
Radioactive Cesium	Radiochemical	7500-Cs B	
	Gamma Ray Spectrometry	7120	D3649-06
Radioactive Iodine	Radiochemical	7500-I B 7500-I C 7500-I D	D3649-06
	Gamma Ray Spectrometry	7120	D4785-08
Radioactive Strontium 89, 90	Radiochemical	7500-Sr B	
Tritium	Liquid Scintillation	7500-^{3}H B	D4107-08
Gamma Emitters	Gamma Ray Spectrometry	7120 7500-Cs B 7500-I B	D3649-06 D4785-08

Alternative testing methods for contaminants listed at 40 CFR 141.74(a)(1)			
Organism	Methodology	SM 21st Edition [1]	Other
Total Coliform	Total Coliform Fermentation Technique	9221 A, B, C	
	Total Coliform Membrane Filter Technique	9222 A, B, C	
	ONPG-MUG Test	9223	
Fecal Coliforms	Fecal Coliform Procedure	9221 E	

Alternative testing methods for contaminants listed at 40 CFR 141.74(a)(1)			
Organism	Methodology	SM 21st Edition [1]	Other
	Fecal Coliform Filter Procedure	9222 D	
Heterotrophic bacteria	Pour Plate Method	9215 B	
Turbidity	Nephelometric Method	2130 B	
	Laser Nephelometry (on-line)		Mitchell M5271 [10]
	LED Nephelometry (on-line)		Mitchell M5331 [11]
	LED Nephelometry (on-line)		AMI Turbiwell [13]
	LED Nephelometry (portable)		Orion AQ4500 [12]

Alternative testing methods for disinfectant residuals listed at 40 CFR 141.74(a)(2)				
Residual	Methodology	SM 21st Edition [1]	ASTM [4]	Other
Free Chlorine	Amperometric Titration	4500-Cl D	D 1253-08	
	DPD Ferrous Titrimetric	4500-Cl F		
	DPD Colorimetric	4500-Cl G		
	Syringaldazine (FACTS)	4500-Cl H		
	On-line Chlorine Analyzer			EPA 334.0 [16]
	Amperometric Sensor			ChloroSense [17]
Total Chlorine	Amperometric Titration	4500-Cl D	D 1253-08	
	Amperometric Titration (Low level measurement)	4500-Cl E		
	DPD Ferrous Titrimetric	4500-Cl F		
	DPD Colorimetric	4500-Cl G		
	Iodometric Electrode	4500-Cl I		
	On-line Chlorine Analyzer			EPA 334.0 [16]

Alternative testing methods for disinfectant residuals listed at 40 CFR 141.74(a)(2)				
Residual	Methodology	SM 21st Edition [1]	ASTM [4]	Other
	Amperometric Sensor			ChloroSense [17]
Chlorine Dioxide	Amperometric Titration	4500–ClO_2 C		
	Amperometric Titration	4500–ClO_2 E		
Ozone	Indigo Method	4500–O_3 B		

Alternative testing methods for contaminants listed at 40 CFR 141.131(b)(1)				
Contaminant	Methodology	EPA Method	ASTM [4]	SM 21st Edition [1]
TTHM	P&T/GC/MS	524.3 [9]		
HAA5	LLE (diazomethane)/GC/ECD			6251 B
	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557 [14]		
Bromate	Two-Dimensional Ion Chromatography (IC)	302.0 [18]		
	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557 [14]		
	Chemically Suppressed Ion Chromatography		D 6581-08 A	
	Electrolytically Suppressed Ion Chromatography		D 6581-08 B	
Chlorite	Chemically Suppressed Ion Chromatography		D 6581-08 A	
	Electrolytically Suppressed Ion Chromatography		D 6581-08 B	
Chlorite – daily monitoring as prescribed in 40 CFR 141.132(b)(2)(i)(A)	Amperometric Titration			4500–ClO_2 E

Alternative testing methods for disinfectant residuals listed at 40 CFR 141.131(c)(1)				
Residual	Methodology	SM 21st Edition [1]	ASTM [4]	Other

Alternative testing methods for disinfectant residuals listed at 40 CFR 141.131(c)(1)				
Residual	Methodology	SM 21st Edition [1]	ASTM [4]	Other
Free Chlorine	Amperometric Titration	4500-Cl D	D 1253-08	
	DPD Ferrous Titrimetric	4500-Cl F		
	DPD Colorimetric	4500-Cl G		
	Syringaldazine (FACTS)	4500-Cl H		
	Amperometric Sensor			ChloroSense [17]
	On-line Chlorine Analyzer			EPA 334.0 [16]
Combined Chlorine	Amperometric Titration	4500-Cl D	D 1253-08	
	DPD Ferrous Titrimetric	4500-Cl F		
	DPD Colorimetric	4500-Cl G		
Total Chlorine	Amperometric Titration	4500-Cl D	D 1253-08	
	Low level Amperometric Titration	4500-Cl E		
	DPD Ferrous Titrimetric	4500-Cl F		
	DPD Colorimetric	4500-Cl G		
	Iodometric Electrode	4500-Cl I		
	Amperometric Sensor			ChloroSense [17]
	On-line Chlorine Analyzer			EPA 334.0 [16]
Chlorine Dioxide	Amperometric Method II	4500–ClO_2 E		

Alternative testing methods for disinfectant residuals listed at 40 CFR 141.131(c)(2), if approved by the State		
Residual	Methodology	Method
Free Chlorine	Test Strips	Method D99-003 [5]

Alternative testing methods for parameters listed at 40 CFR 141.131(d)			
Parameter	Methodology	SM 21st Edition [1]	EPA

Alternative testing methods for parameters listed at 40 CFR 141.131(d)			
Parameter	Methodology	SM 21st Edition [1]	EPA
Total Organic Carbon (TOC)	High Temperature Combustion	5310 B	415.3, Rev 1.2 [19]
	Persulfate-Ultraviolet or Heated Persulfate Oxidation	5310 C	415.3, Rev 1.2
	Wet Oxidation	5310 D	415.3, Rev 1.2
Specific Ultraviolet Absorbance (SUVA)	Calculation using DOC and UV_{254} data		415.3, Rev 1.2
Dissolved Organic Carbon (DOC)	High Temperature Combustion	5310 B	415.3, Rev 1.2
	Persulfate-Ultraviolet or Heated Persulfate Oxidation	5310 C	415.3, Rev 1.2
	Wet Oxidation	5310 D	415.3, Rev 1.2
Ultraviolet absorption at 254 nm (UV_{254})	Spectrophotometry	5910 B	415.3, Rev 1.2

Alternative testing methods with MRL ≤ 0.0010 mg/L for monitoring listed at 40 CFR 141.132(b)(3)(ii)(B)		
Contaminant	Methodology	EPA Method
Bromate	Two-Dimensional Ion Chromatography (IC)	302.0 [18]
	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557 [14]

Alternative testing methods for contaminants listed at 40 CFR 141.402(c)(2)					
Organism	Methodology	SM 20th Edition [6]	SM 21st Edition [1]	SM Online [3]	Other
E. coli	Colilert		9223 B	9223 B-97	
	Colisure		9223 B	9223 B-97	
	Colilert-18	9223 B	9223 B	9223 B-97	
	Readycult®				Readycult® [20]

Alternative testing methods for contaminants listed at 40 CFR 141.402(c)(2)					
Organism	Methodology	SM 20th Edition [6]	SM 21st Edition [1]	SM Online [3]	Other
	Colitag				Modified Colitag™ [13]
	Chromocult®				Chromocult® [21]
Enterococci	Multiple-Tube Technique			9230 B-04	

Alternative testing methods for contaminants listed at 40 CFR 141.704(b)		
Organism	Methodology	SM 20th Edition [6]
E. coli	Membrane Filtration, Two Step	9222 D/9222 G

Alternative testing methods for contaminants listed at 40 CFR 143.4(b)					
Contaminant	Methodology	EPA Method	ASTM [4]	SM 21st Edition [1]	SM Online [3]
Aluminum	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]			
	Atomic Absorption; Direct			3111 D	
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Chloride	Silver Nitrate Titration		D 512-04 B	4500-Cl^- B	
	Ion Chromatography			4110 B	
	Potentiometric Titration			4500-Cl^- D	
Color	Visual Comparison			2120 B	
Foaming Agents	Methylene Blue Active Substances (MBAS)			5540 C	
Iron	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct			3111 B	

Alternative testing methods for contaminants listed at 40 CFR 143.4(b)					
Contaminant	Methodology	EPA Method	ASTM [4]	SM 21st Edition [1]	SM Online [3]
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Manganese	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct			3111 B	
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Odor	Threshold Odor Test			2150 B	
Silver	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct			3111 B	
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Sulfate	Ion Chromatography			4110 B	
	Gravimetric with ignition of residue			4500-SO_4^{-2} C	4500-SO_4^{-2} C-97
	Gravimetric with drying of residue			4500-SO_4^{-2} D	4500-SO_4^{-2} D-97
	Turbidimetric method		D 516-07	4500-SO_4^{-2} E	4500-SO_4^{-2} E-97
	Automated methylthymol blue method			4500-SO_4^{-2} F	4500-SO_4^{-2} F-97
Total Dissolved Solids	Total Dissolved Solids Dried at 180 deg C			2540 C	
Zinc	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct Aspiration			3111 B	
	Inductively Coupled Plasma			3120 B	

[1] Standard Methods for the Examination of Water and Wastewater, 21st edition (2005). Available from American Public Health Association, 800 I Street, NW, Washington, DC 20001-3710.

[2] EPA Method 200.5, Revision 4.2. "Determination of Trace Elements in Drinking Water by Axially Viewed Inductively Coupled Plasma-Atomic Emission Spectrometry." 2003. EPA/600/R-06/115. (Available at http://www.epa.gov/nerlcwww/ordmeth.htm.)

[3] Standard Methods Online are available at http://www.standardmethods.org. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only online versions that may be used.

[4] Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or http://astm.org. The methods listed are the only alternative versions that may be used.

[5] Method D99-003, Revision 3.0. "Free Chlorine Species ($HOCl^-$ and OCl^-) by Test Strip," November 21, 2003. Available from Industrial Test Systems, Inc., 1875 Langston St., Rock Hill, SC 29730.

[6] Standard Methods for the Examination of Water and Wastewater, 20th edition (1998). Available from American Public Health Association, 800 I Street, NW, Washington, DC 20001-3710.

[7] Method ME355.01, Revision 1.0. "Determination of Cyanide in Drinking Water by GC/MS Headspace," May 26, 2009. Available at http://www.nemi.gov or from James Eaton, H & E Testing Laboratory, 221 State Street, Augusta, ME 04333. (207) 287-2727.

[8] Systea Easy (1-Reagent). "Systea Easy (1-Reagent) Nitrate Method," February 4, 2009. Available at http://www.nemi.gov or from Systea Scientific, LLC., 900 Jorie Blvd., Suite 35, Oak Brook, IL 60523.

[9] EPA Method 524.3, Version 1.0. "Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry," June 2009. EPA 815-B-09-009. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.

[10] Mitchell Method M5271, Revision 1.1. "Determination of Turbidity by Laser Nephelometry," March 5, 2009. Available at http://www.nemi.gov or from Leck Mitchell, Ph.D., PE, 656 Independence Valley Dr., Grand Junction, CO 81507.

[11] Mitchell Method M5331, Revision 1.1. "Determination of Turbidity by LED Nephelometry," March 5, 2009. Available at http://www.nemi.gov or from Leck Mitchell, Ph.D., PE, 656 Independence Valley Dr., Grand Junction, CO 81507.

[12] Orion Method AQ4500, Revision 1.0. "Determination of Turbidity by LED Nephelometry," May 8, 2009. Available at http://www.nemi.gov or from Thermo Scientific, 166 Cummings Center, Beverly, MA 01915, http://www.thermo.com.

[13] Modified Colitag™ Method. "Modified Colitag™ Test Method for the Simultaneous Detection of *E. coli* and other Total Coliforms in Water (ATP D05-0035)," August 28, 2009. Available at http://www.nemi.gov or from CPI International, 5580 Skylane Boulevard, Santa Rosa, CA 95403.

[14] EPA Method 557. "Determination of Haloacetic Acids, Bromate, and Dalapon in Drinking Water by Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)," September 2009. EPA 815-B-09-012. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.

[15] AMI Turbiwell, "Continuous Measurement of Turbidity Using a SWAN AMI Turbiwell Turbidimeter," August 2009. Available at http://www.nemi.gov or from Markus Bernasconi, SWAN Analytische Instrumente AG, Studbachstrasse 13, CH-8340 Hinwil, Switzerland.

[16] EPA Method 334.0. "Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer," September 2009. EPA 815-B-09-013. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.

[17] ChloroSense. "Measurement of Free and Total Chlorine in Drinking Water by Palintest ChloroSense," August 2009. Available at http://www.nemi.gov or from Palintest Ltd, 21 Kenton Lands Road, PO Box 18395, Erlanger, KY 41018.

[18] EPA Method 302.0. "Determination of Bromate in Drinking Water using Two-Dimensional Ion Chromatography with Suppressed Conductivity Detection," September 2009. EPA 815-B-09-014. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.

[19] EPA 415.3, Revision 1.2. "Determination of Total Organic Carbon and Specific UV Absorbance at 254 nm in Source Water and Drinking Water," August 2009. EPA/600/R-09/122. Available at http://www.epa.gov/nerlcwww/ordmeth.htm.

[20] Readycult® Method, "Readycult® Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters," January, 2007. Version 1.1. Available from EMD Chemicals (affiliate of Merck KGaA, Darmstadt, Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297.

[21] Chromocult® Method, "Chromocult® Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and *Escherichia coli* in Finished Waters," November, 2000. Version 1.0. EMD Chemicals (affiliate of Merck KGaA, Darmstadt, Germany), 480 S. Democrat Road, Gibbstown, NJ 08027-1297.